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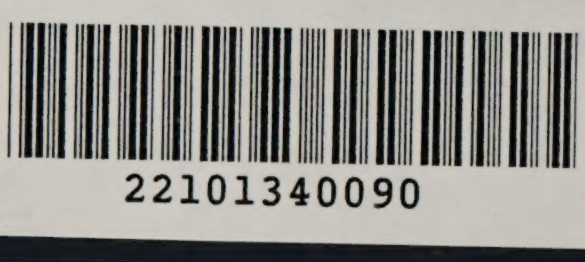
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A SYSTEM

OF

PRACTICAL THERAPEUTICS.

EDITED BY

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VOL. IV.—PART I.

WITH ILLUSTRATIONS.

EDINBURGH & LONDON:

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PREFACE.

The fact that the System of Therapeutics edited by the undersigned met with a most cordial reception on the part of the medical profession indicated that at that time some exhaustive and authoritative representation of practical and modern treatment was needed; and the advances made in this department of medicine have been so great within the last five years that a single volume embodying the present views of the most experienced men in all branches of medicine seems again desirable.

In the preparation of this volume the Editor has kept in mind the fact that it must bring to each reader the personal methods of its various contributors rather than discuss every plan of treatment which has been introduced, whether it be commonly employed or not.

Too often works composed of the contributions of many writers vary greatly in the value of the articles and in the professional standing of their authors, and too often these contributors are largely residents of one district and therefore mirror peculiar local views or measures, so that the work fails to convey the results or the methods employed by men meeting with ailments under various climatic conditions. The wide geographical distribution of the authorities who have written these articles prevents any such fault.

Again, bare suggestions that this drug or that be given in the presence of certain conditions is not what the practising physician wants. He desires definite directions as to its dosage and its prescription, and he wishes to know how the author himself would use the remedies he commends if he were at the bedside. For this reason a large number of illustrative prescriptions are included in the text.

The promptness of the various contributors in sending in their articles and the rapid work of the printing-office enable the Editor to present the most recent ideas as to rational therapy, and he desires to express his appreciation of the courtesy of his collaborators in this very considerable undertaking.

H. A. Hare.

222 S. Fifteenth St., Philadelphia,
May, 1897.

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RECENT ADVANCES IN HYDROTHERAPY.

By SIMON BARUCH, M. D.

In reviewing the subject assigned to the author, he purposes to pursue the line adopted in the article in Vol. I. of this System.

BATHS FOR HYGIENIC PURPOSES.

The principles and methods of bathing for the preservation of health referred to in the article on this subject in Vol. I. have received extensive recognition in this country during the past five years. The brief outline of the theory and technique of the *rain-bath* offered in my earlier contribution has borne good fruit. This fact is evidenced by numerous inquiries received by the author from institutions for details of construction and statistical data; also by the actual construction of rain-baths in many public institutions, asylums, and prisons, the most recent example being the Kings County Penitentiary. The *public rain-bath* has also been freely ventilated. Private philanthropy has provided such rain-baths in several instances in the larger cities of this country. In New York City the Association for Improving the Condition of the Poor in New York has had in full and successful operation for several years a bath-house, consisting of a two-story building of 61×27 feet, in which from 75,000 to 80,000 people annually obtain cleansing baths of soap and warm water. The Riverside Association devotes the basement of its building, a space of 68×25 feet, to baths, which affords facilities for 400 daily, and was actually used by 30,000 people in twelve months.

These small bath-houses illustrate the advantages of the rain bath for public bath purposes, demonstrating the fact that the same number of bathers would require one hundred times more space, eight times more water, a staff four times larger, if the tub or pool bath were adopted. Nor would the latter be as safe as the rain-bath, or as agreeable and as adequate for cleansing people who are soiled in the course of their occupations.

A more marked advance still in the hygienic utilization of the rain-bath may be chronicled in the passage of a law by the New York Legislature, making mandatory provision for public baths for all cities exceeding 50,000 inhabitants. The authorities of the city have

adopted the rain-bath by reason of its saving of cost and labor and its perfect protection against contagion.

A new era in sanitation has thus been inaugurated during the past five years by the introduction of the rain-bath (as indicated on page 455, Vol. I.) to the attention of the lay and professional public.

HYDROTHERAPY IN DISEASE.

Action of Water.—Considerable advance has been made in recent years in the elucidation of the rationale of the action of water in disease by the researches of Winternitz, Loewy, Cohnstein and Zuntz, Alois Strasser, Vinaj and Maggiora, Thayer, and others.

Effect of Hydrotherapy on the Circulation.—Storoscheff has shown that cold wet packs of thirty to forty minutes increase blood-pressure during the first five minutes. Although this is somewhat diminished later, the actual increase continues for a period of half an hour. The pulse is twelve to twenty beats less, continuing slow and regular for some time. The same effect is produced by douches of a half to one and a half atmospheres for 64° to 118° F. The Scotch douche, consisting of alternating streams of hot and cold water, causes immediate diminution of blood-pressure and renders the pulse-beats slower.

Pressure.—It has been clearly demonstrated by Vinaj of Andorno, Italy, that pressure is an important and hitherto much-neglected element in the therapeutic effect of douches. By means of Mosso's ergograph the muscular resistance to fatigue was precisely measured before and after douches of various temperatures, showing unerringly that each pound of pressure tends to increase the muscular resistance positively. A douche of 50° F. delivered under a pressure of two atmospheres (30 lbs. to the square inch) increased muscular capacity threefold. In an ordinary tepid bath in which pressure plays no rôle the effect on the muscles was absolutely *nil*, while a douche under two atmospheres with water at the same neutral temperature greatly enhanced the working capacity of the muscles.

Unfortunately the importance of grading the pressure of hydriatric procedures has not been so well recognized as that of grading the temperature, hence physicians still labor under the erroneous idea that temperature and perhaps duration are the only important elements in hydrotherapy. The experiments of Vinaj would indicate that attention to pressure-effects would give the physician valuable aid in adapting the douche to the indication of each individual case. Indeed, the neglect of this individualization in hydriatric procedures is one of the causes of the uncertain tenure of hydrotherapy in the minds of the medical profession. Recent literature has demonstrated satisfac-

torily that whenever physicians will as thoroughly familiarize themselves with the effects of water on the human organism in health and disease as they endeavor to do with regard to the effects of medicinal agents, they would surely obtain results which would seem inconceivable from so simple an agent.

The careful experiments of an American physician, Dr. Riley of Battle Creek, Michigan, deserve commendatory mention in connection with this subject. After giving a brief summary of the well-known nervous mechanism—showing how the spinal ganglia with their central and peripheral nerve-extensions form the great afferent paths by which all stimuli acting on the nerves ending in the skin reach the nerve-centres within the body—he correctly insists that the effect of a cool shower-bath depends, within certain limits—

1. On the temperature of the water;
2. On the mechanical impact of the water on the body;
3. On the extent of surface exposed;
4. On the duration of the bath;
5. On the manual force applied during and after the bath in the form of friction.

Placing one arm in water at 70° F. for half an hour makes the muscles of that arm more firm, hard, and elastic to the touch than the other arm, the increased tonicity being produced either by the direct effect of the cold or by reflex stimulation conveyed by afferent fibres to the spinal cord, thence through the substance of the cord by way of collateral bundles (the reflex collateral fibres of Kölliker) to the anterior horn of the gray matter of the cord, and finally through the axis-cylinder process of the spinal motor cells to the muscles.

Riley experimented on the effect of a spray bath at from 55° to 90° F., under ten pounds pressure, upon the pulse and respiration of a healthy man, and found that the cool spray bath reduces the frequency of the pulse from five to twenty beats, diminishing under lower water-temperature and increased extent of surface of application. A temperature of 90° F. lessened the pulse of a feeble individual as much as a temperature of 60° F. did in the pulse of a more robust person. The sphygmographic tracings show that a cool spray bath diminished the length of the upstroke and partially or entirely obliterated the line of descent. Such a pulse-tracing would indicate a narrowing of the calibre of the vessels, producing heightened arterial pressure. By reflex action, this effect when produced on one part of the body, as for instance in one immersed arm, is also noted in the opposite arm to a certain extent. From this result may be safely deduced a similar effect on the blood-vessels of the internal organs (increasing the amount of blood circulating in them), when the entire body is subjected to any cold-water procedure. Passive con-

gestions existing in the internal organs may thus be removed and their functions be materially improved. Thus may be clearly explained the marked effect of cold douches, adapted to each individual case, in ameliorating or entirely removing diseased conditions which have resisted medicinal and other treatment.

The effect of heat and cold upon the *composition of the blood* has been recently studied by numerous observers. Winternitz, who must always stand in the front rank, Rovighi, Thayer of Johns Hopkins Hospital, Loewy, and others have labored in this fruitful field. Under the influence of heat externally applied to the entire body, the blood becomes more watery, the number of red cells being diminished. This result is probably due to a widening of the immense capillary area, and a changed relation of the red blood-cells in the vascular system, due to a stasis in the large interior vessels.

General cold applications to the surface of the body increased the number of corpuscular elements and the quantity of hæmoglobin almost constantly, if the application was not too prolonged. A threefold increase of leucocytes and an increase of nearly one and a quarter millions of red corpuscles, and of 14 per cent. of hæmoglobin have also been observed, this increase continuing manifest to a diminished degree for an hour. These results may be reasonably explained by the effect of cold applications upon the tone and calibre of the blood-vessels. The cutaneous and subcutaneous vessels are contracted by cold, blood-pressure is increased; the heart acts with more force, driving many corpuscles which have lain partly dormant in the byways of the blood-circulation, out into the rapid general current.

Local applications of cold invariably increase the corpuscular elements of the blood at the point of application, while these are decreased in blood taken from parts distant from the latter.

The proportion of white to red corpuscles is changed by cold applications, the former being increased threefold in health and disease, and the condition is usually maintained for half an hour after the cold hydriatric procedure, but sometimes lasts two hours.

The effect of cold and hot applications upon the *calibre of the cutaneous vessels*, and the consequent compensatory changes in underlying muscular and other vessels, have been again clearly demonstrated. The increase of blood-pressure consequent upon cold applications, and its diminution by warm applications, have also been too often noted by reliable observers to be gainsaid. Brief applications of cold improve the "tone" of the muscular coats of the vessels; heat diminishes it.

These pronounced and undeniable effects upon the circulation of the blood in all its phases enable the practitioner to explain to himself all hydriatric procedures rationally, and to practically and under-

standingly utilize water as an auxiliary remedial agent of unsurpassed value.

Clinical demonstrations offer incontrovertible evidence of the progress made in hydrotherapy in recent years. Never in the history of medicine has water received such appreciative recognition as it has obtained during the past few years. In the acute infectious diseases especially, clinical observations of the effects of water have been abundant.

The claims made as to the value of this agent in Vol. I. of this SYSTEM have, therefore, been fully confirmed.

TYPHOID FEVER.

Despite unremitting and conscientious attention given to its prevention and treatment by the medical profession, this disease stands pre-eminent among infectious diseases by reason of its universal prevalence, its fatal character, and the failure of all specific medication.

The idea is now all but universally accepted that we are called upon to combat in this disease a toxæmia which overwhelms the central nervous system and cripples all the organs which depend upon its perfect integrity for their functionating impetus and power. Death ensues in typhoid fever mainly from failure of the heart to perform its function in accordance with the demands made upon it by the changed conditions existing in the organism. Intestinal ulcerations, with their terrific sequelæ, hæmorrhage and perforation, hypostatic pneumonia, embolic processes, indeed most of the lethal complications, are the direct or indirect result of enfeebled heart-action. Heart-failure stands like a spectre at the bedside and bids the physician defiance. How helpless we have been hitherto in its presence, when medicinal agents were our only refuge, every physician knows but too well.

Clinical observation during the past five years has confirmed the view expressed before that the application of cold water in this disease has made a complete change in our position. We now possess a perfect heart-tonic whose action is not otherwise detrimental to the organism, but on the contrary endows it with power to withstand the inroads made upon it by the toxæmia and thus ward off all its resultant dangers. In recent years American clinicians have actively labored to demonstrate the great potency of the Brand method, which in an earlier volume I described and earnestly advocated. We may point with satisfaction to the achievements of James C. Wilson, Pepper, Tyson, and Hare of Philadelphia, Wilkins of Montreal, Peabody, Delafield, Gilman Thompson, and Ball of New York, Osler of Baltimore, Sihler of Cleveland, and of many others, to illustrate that

the American practitioner, though conservative and cautious, is bold in the courage of his convictions.

In Germany many professors have regarded it as incumbent upon them to modify the Brand method to suit their own ideas. As a consequence, cold water alone "remains to tell the tale." Each one of these gentlemen has sought to impress his own individuality upon the method, scorning dependence upon "routine." The logical outcome is that the ideal results achieved by Brand, Juergensen, Vogl, and Strümpell are not obtained by them. Thus it has come about that the "Brand method," which has a definite rationale and scheme which require a definite technique for their attainment, has been mutilated and is becoming a byword in the German clinics. American clinicians, on the contrary, have recognized the necessity of following closely the teachings laid down by that greatest master of fever treatment. Despite their native independence of thought and action, despite their freedom from authoritative domination, they have followed him exactly, with phenomenal results. Indeed, the chief advance in typhoid-fever treatment during the past few years has been in the more complete recognition of Brand's idea that the cold bath does not aim to reduce temperature, but that its chief object is to sustain the nervous system, and that the exact technique of Brand is a *sine qua non.* Prof. Delafield tells his students, "There is but one proper treatment for typhoid fever, and that is by the bath; there is but one proper bath treatment, and that is the exact method of Brand."

Herein lies the kernel of success in the therapy of typhoid fever; every deviation jeopardizes the result. It may be profitable to reiterate here that the Brand method demands the application of baths, at the bedside, of 65° to 70° F., every three hours, with friction, day and night while the body-temperature is 102° F. or more, unless there be hæmorrhage, pleurisy, or other complications demanding absolute rest of the patient. Moreover, a very important element of this treatment is that it should be begun before the fifth day. To demand that the bath treatment be inaugurated before the diagnosis is assured would seem an almost insurmountable obstacle to the execution of this method. I have not found it so, in private practice; hospital cases are rarely admitted so early. It is my custom to begin with a full bath at 90° F., for fifteen minutes *in all fevers* with persistent high temperatures, repeat the bath every three or four hours, and to reduce the temperature five degrees on each repetition, until 65° is reached. Then Brand's rule, to continue baths of 65° F. every three hours, is strictly observed unless chattering of the teeth, cyanosis, or heart-failure demand removal from the tub or discontinuance of the bath. By the gradual introduction to colder baths the patient's

tolerance and reactive capacity are ascertained and symptoms are greatly ameliorated. Thus in the event of typhoid fever developing, an entering wedge has been driven for the scattering of the enemy's forces which are besieging the nerve-centres.

If the rectal temperature be reduced two or more degrees by any one of these baths during the first week, the physician may feel assured that he has not a case of typhoid fever before him, but either a general tuberculosis, a central pneumonia, or some febrile disease of ephemeral character. That the temperature-reduction by the cold baths is feeble in the early days of typhoid fever has been too often observed by the author to be an accidental phenomenon, and he therefore regards the cold bath as a *valuable diagnostic aid* when other evidences of typhoid fever are wanting. Hence the early application of baths varying from 90° to 70° F. in febrile diseases with high temperatures is of great benefit to both physician and patient. Its neglect would seem unpardonable, if thereby we may gain a point of vantage in the event of the development of typhoid fever. The objection is often, however, made that the cold bath is troublesome, cruel, and expensive. There is some truth in these objections, but it is a fact that inasmuch as a mortality of about 20 per cent. is saved, the trouble, expense, and cruelty of the treatment in this number of saved patients is but trifling when compared with the trouble, expense, and cruelty involved in their probable deaths. Until some other less heroic method is discovered the Brand method must remain the most reliable and trustworthy method of managing typhoid-fever patients.

Much has been accomplished during recent years to explain the remarkable effect of cold-water baths in typhoid fever. The investigations of Winternitz, confirmed by Thayer of Johns Hopkins University, have clearly demonstrated an enormous increase of white polynuclear blood-cells in blood taken from the lobe of the ear after each bath. Metchnikoff has shown by his interesting experimental studies that inflammation is but the phagocytic reaction of the organism to an irritant which has invaded it. The white cells are regarded as phagocytes whose mission it seems to be to dispose of microbes or toxins which find entrance into the blood-current. If this be correct (and it has not up to the present time been altogether controverted, although doubts are thrown upon it by other observers), we have one explanation of the mildness of type which systematic cold-bathing in its early stage impresses upon typhoid fever. The enormous increase of polynuclear white cells is really equivalent to a bringing up of a reserve army to meet the invading Eberth bacilli. Moreover, the enormous increase of urine, often reaching 75 to 100 ounces daily, which is an almost constant result of hydriatric measures

in this disease, together with the increase of toxicity in the urine as shown by Ausset, Roque, and Weil, would positively demonstrate an enhanced elimination of toxic elements which are menacing the patient's life. Adding to these the improved action of the heart and the deepened inspiration, and we have a clear rationale of the effect of cold baths in typhoid fever which must strengthen our convictions and overcome all timidity in its application. It remains to briefly recite the clinical data which support the rationale.

Dr. Wm. Osler of Baltimore has recently stated that the mortality of typhoid fever in Johns Hopkins Hospital has been reduced by the Brand bath to 7.1 per cent. Dr. James C. Wilson of Philadelphia has published a series of 524 cases treated in the German Hospital of Philadelphia, with a mortality of 7.25 per cent. Dr. W. Gilman Thompson of New York records a mortality of 7.75 per cent. at the Presbyterian Hospital, and Dr. Francis Delafield has stated in a recent discussion in the New York Academy of Medicine that during the last five years the mortality for typhoid fever has been very different from what it was some years ago, when he had gathered from large hospital statistics a mortality of 20 to 30 per cent.

To sum up, the recent advance in typhoid-fever treatment results from the recognition of the fact that high temperature is not the hydra-headed monster which Liebermeister and his followers had painted it; that while it is of great import and approximately indicates the severity of the disease, it is not a pre-eminent lethal factor; that the endowment of the organism to withstand the inroads of the disease by means of its invigorating and refreshing effect upon the central nervous system is the chief function of the treatment, and that, for these reasons, the Brand bath, which is a methodical, systematic method, and therefore superior to sponging or other slovenly water-practice, deserves all the encomiums which have been bestowed upon it.

Scarlatina.

In the treatment of this disease hydrotherapy has advanced in the estimation of enlightened practitioners. The author has obtained excellent results from brief cold baths or affusions in the early stage of the disease, when high temperature and feeble heart-action seem to threaten collapse, or when the nervous system was overwhelmed by the poison with or without convulsions. He has rescued many desperate cases whose marbled skin, obscured intellect, shallow respiration, and feeble, rapid pulse menaced life, by plunging them into a tub of water at 80° F. for five to eight minutes, with gentle friction, or by seating them in a tub of water at 100° and pouring with some force basins of water at 60° over head and shoulders and chest. Reaction

resulted almost invariably; the marbled hue gave way to a ruddy coloring, the pulse gained in force and vigor, respiration was deepened, intellect cleared, and rarely was a repetition necessary. In no emergency is the effect of a rational application of water more clearly appreciable than in these unpromising cases of scarlatina in any stage of the disease. Dr. Hiram Corson,[1] a practitioner of high standing in Pennsylvania, correctly estimates the value of cold water in this and other eruptive diseases when he says: "Rarely has any one made more careful trial of any remedy than I have made of water in the practice of fifty-nine years under the daily watch of intelligent physicians, anxious, no doubt, for my success, but doubtful of the propriety of my practice and too timid to resort to so heroic a remedy. And now, in closing my career as a practitioner and looking back on the countless fights had with death in hovel and in palace, I can truthfully declare that no means ever used by me, or which have ever been known to be used by others, in scarlet fever, have so successfully warded off blows and shielded patients from harm, and restored them to health, as the use of cold water and ice."

In *measles* and the other exanthemata the same treatment is applicable, as shown recently by Guinon, Hutinel, and others.

Pneumonia.

The application of cold in the treatment of pneumonia has been advocated in recent years by A. Jacobi of New York, Mays of Philadelphia, and others. The former applies the cold bath, or a pack, whenever the temperature rises above 106° F. in the pneumonia of children. The latter has obtained excellent results from ice, wrapped in towels applied around the chest, in the pneumonia of adults. The results published by Mays and others who have adopted the method are so favorable that a discussion of the rationale of its action may not be unprofitable. Mays holds that the ice-pack produces a direct antiphlogistic effect upon the lung, the cold penetrating through the chest-walls and thus reducing the inflammatory process in the affected lung. This theory, however, is untenable in view of its incompatibility with the accepted rationale of the action of moderately intense cold upon the cutaneous surface, as explained in Vol. I., page 468: "It contracts the arterioles and capillaries and thus weakens the face of the peripheral circulation. At the same time the blood is driven into the underlying muscles, which are endowed with more heat and thus offer an obstruction to the invasion of injurious degrees of cold. This protection is enhanced by the reflex effect of cold applied to the surface which produces a dilatation of the vessels supplying the muscles, and by the resultant genera-

[1] *Journal of Balneotherapy*, March, 1892.

tion of heat. As Adamkiewicz has shown, the feeble heat-conducting power of muscular tissue adds another element to the forces which tend to protect the inner organs against dangerous invasions of cold."

These ice-applications would therefore actually prove detrimental, did not the heat of the body melt the ice and thus keep the towels surrounding it constantly damp, diminishing the intensity of the cold, and really converting the cloths covering the ice into a *wet compress.* The good results obtained by Dr. Mays may therefore be more rationally explained as being due to the fact that it resembles the treatment which Niemeyer and Kussmaul have long ago recommended and which has been used by the writer with phenomenal success as the chief element of therapy in pneumonia during the past five years.

Since I rarely depend upon water alone in the treatment of disease, I begin the treatment of a case of pneumonia with twenty grains of calomel, dry upon the tongue, as recommended and successfully applied by Leaming of New York, fifteen years ago. This is the only medicinal agent, outside of placebos, used by the writer. Whenever the body-temperature reaches 100° F. a thick linen compress, slit in the axillary region, so as to fit high up on the chest, is wrung out of water at 60° F. and snugly placed around the entire chest down to the umbilicus. This is renewed every hour if the body temperature is from 100° to 102° F.; every half-hour if it is higher. The results have been very favorable in my private practice, and in that of Dr. Harry Pemberton of Long Branch. In the J. Hood Wright Memorial Hospital (formerly Manhattan General Hospital) the general mortality of pneumonia has been reduced one-half, while in cases coming under treatment before the fifth day the mortality is now 12 per cent. whereas it was 37 per cent. prior to the adoption of this hydriatric measure by the entire staff of the hospital.

The rationale of this treatment rests upon the repeated gentle shock and subsequent reactive stimulus to the periphery conveyed to the central nervous system, deepening the inspiration and removing mechanical obstruction from the bronchi; invigorating the heart by widening the area of the cutaneous vessels and thus contracting the vessels of the nearest underlying parts, which contraction may reach as far as the affected lung-tissue. The symptoms, high temperature, dyspnœa, rapid and feeble pulse, sleeplessness, etc., subside very early; few, if any, stimulants are required, except in habitual drunkards, but crisis rarely occurs. The patients recover slowly but surely. Occasionally a full bath of 90° and not lower than 80° F. for eight to ten minutes with friction may be required when high temperature and brain-involvement become pronounced. In the latter case no medicinal agent equals this hydriatric measure. In children under twelve years these full baths are used by the writer as a routine treatment

every four hours, never omitting frictions over the entire body, especially over the chest. In the intervals between the baths the chest-packs are assiduously applied as long as the rectal temperature registers over 101° F.

Acute Articular Rheumatism.

This is a disease which offers a good field for the application of a mild local hydrotherapy. The writer has confidence in 20-grain doses of pure salicylic acid or oil of gaultheria every two hours until tinnitus aurium ensues, while compresses of three thin layers of linen cloth, wrung out of water at 60° F., are placed snugly around the inflamed joints and covered by thin flannel. Renewed every hour with as little motion of the joint as possible, this has proved an ideal treatment in my hands. The combination of salicylic acid with local hydrotherapy has proved more efficient in severe cases than either treatment alone during the past five years.

Chronic Diseases.

In the chronic and subacute forms of disease, hydrotherapy continues to offer a valuable auxiliary to the forces of nature, which seem to lie dormant in this type of cases. The course of events in acute disease differs from that of the latter, in the ever-present tendency to recover spontaneously in a large proportion of the former. Hydrotherapy displays in acute maladies a decided influence in marshalling the natural recuperative forces into active and successful participation in the combat. Hence it almost invariably turns the tide in favor of the patient when resorted to in the earliest stages. The same principles are involved and the same results are attainable in chronic and subacute diseases, but in a much smaller proportion. This result is due mainly to the fact that hydrotherapy is rarely called into requisition until decided pathological changes have ensued, which the organism, though aided by powerful means, is no longer capable of removing. Here again the hydrotherapeutic principle, *Obsta principiis,* applies. This principle, which has won for the Brand method in typhoid fever its greatest triumph, asserts its force in other diseases, acute or chronic, with like result.

Chlorosis.

The chlorotic girl who has been plied with iron, arsenic, and peroxide of manganese in their numberless combinations, often goes from bad to worse until she falls into the hands of some one who realizes the importance of improving her nutrition by stimulating the nerve-centres, whence all organic functions are derived, and who satisfies the hunger for oxygen in the blood by exposing it to better

air and in more active currents. Days and weeks may be required to train her reactive capacity up to a point at which douches of low temperature and high pressure may be applied without detriment. This moment having arrived, the shock to the periphery awakens an active response in the central nervous system, which sends the blood in joyous currents to the pallid cheek, which deepens the shallow respiration and arouses all the latent energies of her nature. Had a judicious hydrotherapy been earlier applied, while her reactive capacity was not yet in abeyance, much more rapid progress would have been obtained. In all those functional neurotics who are the bane of the doctor's life, as they wander from one physician's office to another in a vain search for help, no remedy approaches in beneficent results the methodical application of water. Many of these cases recover under any judicious management which includes removal from unfavorable environment; they are all, however, more or less benefited by hydrotherapy.

Neurasthenia.

This condition offers a fruitful field for hydrotherapy. For the correct application of the latter, two forms of this many-sided malady must be distinguished—the depressed and the irritable. The former is more amenable to hydrotherapy than the latter. In both the treatment may be inaugurated by ablutions. The patient, standing in water at 100° F., receives from the hollow hand of an attendant, previously dipped into a basin of water at 90° F., dashes of water upon the back and chest and abdomen, with occasional friction with the flat wet hands. The patient is then dried with friction. The temperature of the basin water should be reduced daily one or two degrees until 60° F. is reached. Then larger quantities are poured from a pitcher or basin upon the patient standing in warm water up to his malleoli, beginning with 80° F. and reducing daily one or two degrees until 55° F. is reached. If reaction is good, the water-temperature may be lowered and the quantity applied may be increased. Friction in drying may be discontinued so soon as the patient's reaction is good. It is important that the patient remain in motion in the open air immediately after treatment. If this method do not induce improvement, douches of the same temperature, beginning with 10 lbs. pressure and gradually increasing the latter as the water-temperature is diminished, and prolonging the application gradually from five to thirty seconds, will probably succeed. The aim of this treatment is to arouse the central nervous system, to stimulate by this route the general and local nutrition, and to equalize the abnormal circulation.

In the *irritable* form of neurasthenia, baths and half-baths or hip-baths of 90° F. daily reduced one degree but not lower than 80° F.,

and prolonged for five minutes by gradual increase to fifteen minutes, are useful. Here the shock of low temperature and high pressure must be avoided, because the subsequent reaction would be violent and serve to enhance the existing erethism. Wet packs at 90° to 80° F., of an hour's duration, followed by half-baths of two to five minutes at the same or somewhat lower temperature, with active friction in the bath and afterward, have proved useful in this type of cases.

The most important elements in the management of these cases are individualization and precision in technique. In no therapeutic plan is a correct appreciation of the demands of each case of more import than in hydrotherapy. The writer has often seen cases recover completely after failure under injudicious hydrotherapy. A case of *insomnia*, recently referred to him by Dr. Wharton Sinkler of Philadelphia, may be cited as illustrating this point. The man had been treated for many months at Baden-Baden and in New York by various hydriatric procedures, without result, but his ailment yielded after two months' cautious and watchful application of a precise, graduated, and correctly adapted hydrotherapy. The error in this case, which is referred to as a warning, seemed to lie in the too frequent repetition, two or three times daily, of cold or hot packs, while hypnotics continued to be resorted to. If space permitted many clinical histories might be cited to illustrate the importance of making *an improvement of nutrition* the chief aim of hydrotherapy in neurasthenia and in other functional neuroses. Following this principle, and gradually introducing the patient into the treatment without shock and harshness, will surely verify in the experience of the judicious physician the opinion expressed of hydrotherapy by that most successful neurological therapeutist, Prof. Erb of Heidelberg,[1] that "Its results in all possible forms of chronic nerve-diseases are extraordinarily favorable."

Nervous dyspepsia belongs to the category of functional neuroses, in which hydrotherapy displays the most beneficent results.

Dr. Weir Mitchell recommends the dripping sheet as the most valuable hypnotic for patients subjected to the rest-cure, while F. Peterson advocates baths 70° to 90° F. lasting one-half to two hours, for producing sleep. As a general hypnotic applicable to all forms of insomnia among the insane, Dr. Peterson finds the hot wet pack of astonishing value.

PHTHISIS.

Phthisis is a disease in which the nutrition is wofully defective. Primarily or secondarily emaciation points with unerring finger to a serious fault in the nutritive processes. From the earliest period of

[1] *Ziemssen's Cyclopædia*, vol. v., art. "Spinal Diseases."

phthisio-therapy it has been the aim of physicians to remedy this faulty condition. How sadly it has failed every experienced practitioner has realized. The Montefiore Home for Chronic Invalids has many records of the brilliant effects of hydrotherapy in improving hæmatosis, increasing heart-vigor, deepening inspiration, and thus putting the staggering organism into condition to wage a more successful combat with the invading bacillus. A recent visit to the great sanitaria for phthisis at Goerbersdorf and Falkenstein, where Brehmer, Roempler, and Dettweiler have made such striking reductions of the mortality of this disease, has convinced the writer how highly hydrotherapy is esteemed by these authorities as an important auxiliary in the hygienic and dietetic management of phthisis. Although the method adopted in these institutions seemed crude and rather heroic, the results were good. It appears to the writer that a more gradual inuring of the phthisical patient to low temperatures and strong pressures would bring even more satisfactory results. Such a method is adopted in the Montefiore Home. As it is briefly referred to above under the head of Chlorosis, it may suffice here to state that the same procedure, barring the very low temperatures (not below 70° F.), may be adopted in phthisis with advantage.

The writer has reported [1] a case of phthisis which had been condemned to exile by an eminent consultant,—tubercle bacilli being found in abundance and all the physical and other signs of the first stage of phthisis being present. This case was entirely restored after five months of graduated hydrotherapy, all medication being stopped. A gain of sixteen pounds and of five pounds over his greatest weight in health demonstrated the value of this treatment in improving nutrition. A brother of this patient, who had also been condemned to exile from home, was similarly restored. Both continue to reside in this city.

Among the hospital cases was one, aged thirty-three, disease of one and a half years' duration, beginning with hæmoptysis, who gained twenty-six pounds and coughed so little that no sputum could be furnished for examination when he was discharged. Another, thirty-six years of age, ill two and a half years, beginning with hæmorrhages, gained twenty-one pounds, lost all bacilli from sputum, and returned to work. Another, aged thirty-one, ill one year, with repeated hæmorrhages, was discharged after one year's treatment, with a gain of twenty pounds, without bacilli and with insignificant physical signs, being able to return to work as a street-railway conductor. These cases, observed by several members of the medical staff, are cited as evidence of progress in the utilization of hydrotherapy in a disease which baffles our best efforts and in which its application is usually regarded with disfavor.

[1] *Medical Record*, 1893.

Chronic Rheumatic Affections.

Sciatica, lumbago, and other forms of *chronic rheumatism*, muscular and articular, are favorably influenced by properly applied hydrotherapy, after failure of other treatment. The hot-air bath with a view to increase perspiration and tissue-change, followed by gradually reduced general douches, and local Scotch (alternating steam and cold jet) douches are praised by Buxbaum and others. Gradually reduced cold douches, to avoid shock and chilling, have proved of surpassing value in the hands of Pospischl and Winternitz, who report some striking cases. I can confirm these favorable results by personal observation in my own practice.

Diseases of the Spinal Cord and Nervous System.

In the therapeutics of the degenerative diseases of the spinal cord, Curran Pope of Louisville claims that hydrotherapy offers the greatest chances of success. He never allows patients to take such baths at home, since the results are not satisfactory, but has them treated at an institution where temperature and pressure may be properly graded.

Leyden and Canova have obtained good results from hydrotherapy in *tabes*. They warn against low temperatures and long-continued treatment.

The *dermato-neuroses* are treated by Beni-Barde with hot douches. *Lichen planus* was successfully managed by him with douches of 95° F. from three to six minutes. Obstinate *pruritus* has yielded in my hands to hydrotherapy after failure of treatment by eminent dermatologists.

These brief notes are cited to demonstrate the progressive use of water in chronic diseases. The results of hydrotherapy may be profitably summed up in the words of Draper, addressed to the New York Academy of Medicine. He claims that hydrotherapy is "useful in all disturbances of innervation depending on or coexistent with instability of the vasomotor system. In cases in which the nutrition has been enfeebled by chronic disease, such as *catarrhal* and *rheumatic affections*, by emotional shocks, or by alcoholic and venereal excesses, and in the protean derangements caused by so-called *neurasthenia*, or *spinal irritation*, in *hysteria* and *hypochondriasis*, the good effects of the cold bath are very striking. It seems to be more effective than any treatment by medicines, stimulating nerve-centres, restoring the equilibrium of the circulation, and reviving the activity of the organic functions. The application of the cold bath requires much discretion and trained intelligence. Its best results require the appointment of a well-ordered establishment, where all the various methods of applying cold by means of water can be wisely and skilfully directed. It is

probable that the methods of application are of less importance than the judicious regulation of the temperature and the duration and frequency of the baths."

In *chronic malarial fever* Strasser, Fodor, and Buxbaum have obtained striking results in the Allgemeine Poliklinik in Vienna, after failure of quinine, from baths of 60° F. for two minutes with some friction, also from colder douches, both administered half an hour before the expected paroxysm.

Remarkable results are claimed by Florian from daily warm baths in *chronic nephritis,* a practice highly commended by Prof. Albin Hoffman of Leipzig.

Conclusions.—In concluding this article on hydrotherapy, the writer would emphasize the fact that hydrotherapy is by no means a universal remedy ; that the claims set forth in this article and in Vol. I. are purely for its value as an auxiliary in enhancing vital resistance, endowing the healthy human organism with capacity to resist the invasion of disease, and in sickness enabling it to successfully combat the depreciating forces which conduce to a lethal termination. The author could not disregard the results of his personal clinical observation of one-third of a century, and consent to substitute water for all other therapeutic agents. Drugs which possess the power of reducing or increasing the rate of the pulse, of diminishing or enhancing its tension, of lowering the temperature, lulling to rest the wearied brain, completely abolishing local or general sensation, etc., are entitled to the respectful consideration of the conscientious and broad-minded physician. Water, however, is the most ancient remedy we possess ; coming down to us through the ages from the time of Hippocrates, it has, despite its mutations, won a high place in therapeutics. To render this position permanent it is necessary that the general practitioner learn to utilize water correctly, with regard to selection of temperature, duration, pressure, and technique—in short, to apply the same care, skill, and attention which he devotes to drugs. It is the aim of the writer to further this propaganda, the success of which is illustrated in these pages.

MINERAL SPRINGS.

In this branch of our subject no substantial advance has been made recently, except by the utilization and careful study of one spring, which is referred to in detail below. True, many new springs have been exploited, claiming, as usual, properties superior to others ; there is, however, more need of a better acquaintance with older springs and not so much with their therapeutic properties, and with the therapeutic methods adopted by the medical men residing near them.

The results obtained at health-resorts are due chiefly to the proper management of the patients and to the correct application of the balneological and climatic conditions in each individual case.

A recent visit to a large number of the most famous springs in Germany has convinced the writer that it is really more important to know the doctor to whom cases are referred than to understand the chemical constituents of the water he applies. The reputation of a spring or Bad is usually earned by the skill of the physicians who there minister to invalids. Instead, therefore, of offering here a résumé of my observations on various new springs and their properties, I propose to enter into a somewhat detailed description of one spring which illustrates the point referred to above, and at the same time presents the most substantial advance made in balneology in recent years.

Bad Nauheim, which is reached in about an hour's ride by express train from Frankfort-on-the-Main, lies nearly 450 feet above the sea-level at the foot of the Taunus Mountains. Nature and art have combined to make it an ideal resort for patients suffering from cardiac affections. This quiet and well-shaded town possesses a number of saline springs, two of which, the Great Sprudel (No. 7) and Friedrich-Wilhelm Quelle (No. 12), supply the bath-houses. The *sprudel* shoots up in a stream several feet high, and falls into a large stone basin, from which it is distributed by pipes into the old and new bathing establishments. The water contains 2 or 3 per cent. of chloride of sodium, 2 to 3 per mille of chloride of calcium, and a large proportion (about $\frac{1}{3}$ c.c. to the litre) of CO_2. The latter is allowed to escape by exposure to the air. The iron contained in it being oxidized, the brine assumes a rusty appearance. Solid salts, obtained by evaporation of the brine, are added to the baths when prescribed by physicians. In bath-houses Nos. 1 and 4, *Sprudelbaeder*, consisting of the carbonic water as it issues direct from the spring before it reaches the exposed basin, is furnished for the wooden tubs, into which it flows as clear as crystal and full of fine bubbles of gas.

The course of baths begins usually with a one per cent. saline bath at 95° F. for five or six minutes; the percentage of salt is gradually increased, and the bath temperature reduced, not below 85° F., while the duration is prolonged gradually to thirty minutes. An occasional intermission of a day is prescribed, as indicated by the effect of the baths. After the patient becomes accustomed to the saline bath and has shown some improvement, he is exposed to the CO_2 baths, and later to the flowing CO_2 baths, which resemble soda-water rushing from a fountain. After the bath the patient is carefully dried with warm sheets and towels, and he is not allowed to make much effort in dressing, but is assisted by the attendant.

The effect of these baths, when carried to the full extent of duration, temperature, and concentration, is to increase the blood-pressure, to enhance the force and diminish the rate of the pulse, and to diminish temporarily the area of cardiac dulness. When the bath-temperature reaches 85° F. an enhancement of the usual effect of baths so much below the body-temperature is observed by reason of the stimulating effect of the saline and CO_2 constituents of the water. After a certain time, depending upon the condition of the patient, a series of mild resisting exercises is begun (*Widerstandsgymnastik*). They consist of nineteen gentle movements of extension and flexion of the muscles of the extremities and trunk made with opposition or resistance by the hand of an attendant. The most important points to be observed are that they be made slowly, without effort and without acceleration of the pulse or the respiration, that each special movement be not made twice, and that an interval of rest obtain after each movement.

The rationale of the system of mineral baths and resisting movements is explained by Schott, one of its originators and promoters, by assuming a reflex stimulating influence upon the cardiac inhibitory centre, by reason of which the pulse is slowed, its tone increased, and the blood-pressure heightened. This theory cannot, however, be maintained in view of the physiological effects of cool baths upon the circulation. It would seem that a far more rational explanation may be found in the well-known stimulating or tonic effects upon the circulation (reflex and hydrostatic) produced by brief applications of water at temperatures below the normal, which stimulation is enhanced by the mineral constituents of the CO_2 gas bubbles, which exert an irritant mechanical effect upon the large cutaneous area. Under this stimulus the cutaneous vessels are dilated—as indicated by redness of the skin when emerging from the bath. This dilatation is not due to relaxation, however, as would be the case after a bath several degrees *above* the normal temperature, but to a stimulation of the entire neuro-vascular supply of the skin, endowing its vessels with increased propulsive power and widening the area of blood-distribution. It has been estimated that the skin is capable of holding 66 per cent. of the entire blood of the human body. But not only is the area of cutaneous vessels increased, but the elasticity of their coats is enhanced. As a result the blood is more vigorously propelled onward, and sufficient normal resistance is created to increase the blood-pressure. In other words, a more normal condition is established in the cutaneous circulation, especially in the arterioles, which are in a state of more or less spastic contraction by reason of retention of products of retrograde tissue-metamorphosis arising from the pre-existing feeble circulation through the emunctories.

In addition to this improved activity of the cutaneous vessels, the muscular vessels are dilated in accordance with a well-known compensatory law. This law provides that when the outer surfaces of the body are exposed to cold, contraction of the vessels ensues, the blood is driven to the surfaces beneath, filling their vessels. If the cold is of brief duration, reaction takes place by reason of which the blood returns to the surface in larger volume and diminishing the supply beneath. If cold is continued, the process of contraction continues, to decided blanching of the surface with corresponding dilatation of the vessels of the underlying parts. If the application is intensely cold, destruction of tissue takes place, as is well known, but this destruction is limited by the larger blood-supply of the underlying parts, protecting the latter against damage. When, after the mineral bath of 82°–90° F., the patient emerges and is rubbed with a warm cloth, producing redness by dilating the cutaneous vessels, the blood is drawn from the muscular vessels and the latter are contracted by the enhanced tonicity of the muscles. The result of this stimulus of the peripheral circulation is increased blood-pressure, more vigorous systole and more complete emptying of the ventricle. The heart is not hampered, as in the case of digitalis, by contracted arterioles, but on the contrary is aided by their supernormal activity. The gentle exercises have precisely the same effect on the muscular vessels. Thus may be explained the immediate effect of these mineral baths upon the force and rhythm of the heart, the increased tension and diminished rate of the pulse. This explanation, viz. the contraction of the muscular arteries and (tonic) dilatation of the cutaneous vessels, disposes of the contradictions involved in the rationale offered by various observers, Bezley Thorne, Schott, Saundby, and Broadbent. As a result of the more vigorous systole and less impeded circulation in the peripheral vessels, improvement in the secretion of urine ensues, which in turn reacts beneficially by eliminating toxic products.

A diminution of the area of cardiac dulness has been noted by many independent observers in Germany and in England, and is confirmed by Newton M. Heinemann of New York, who is well known for acuteness of observation and accuracy of statement. How much of this diminution of area of cardiac dulness may be due to the actual effect of the baths and exercises and how much to the percussion over the area which is resorted to for the purpose of outlining it, remains in doubt, when we consider that M. Heitler[1] has shown by actual experiment that an enlarged area of cardiac dulness was invariably diminished by tapping over it. Be this as it may, the clinical results demonstrate the value of this treatment. In a paper read before the

[1] *Ueber die Wirkung thermischer und mechanischer Einflüsse auf den Tonus des Herzmuskels,* Wien, 1894.

Verein für innere Medizin, Berlin, in February, 1894, Dr. Heinemann related 77 cases observed by him at Nauheim, which he studied very closely. Of these, 40 visited the springs for the first time. Of the remaining 37, 25 returned three times or oftener, 15 four times or oftener, and 11 five times or oftener. This statement would indicate that the majority of the cases treated at Nauheim had improved sufficiently to warrant the continuance or repetition of the treatment. In a large proportion the patients reported that they were enabled as its result, during the succeeding winter and spring, either to dispense with medicinal treatment or to obtain far better results from it than hitherto.

Nearly all disturbances of the circulation are adapted for the Nauheim system, especially valvular disease with loss of compensation. True angina should be treated by baths chiefly. Graves' disease, congenital cardiac defects, also hearts enfeebled by influenza, are sometimes benefited. Dropsy does not contraindicate the treatment; it is not infrequently removed by it. Cirrhosis of the liver and nephritis, great debility, aneurism of the aorta, and pronounced forms of arterio-sclerosis are contraindications to its use.

Without indulging in utopian ideas, I regard the Nauheim system of treating certain cardiac diseases as a permanent improvement in therapeutics provided it is followed judiciously on the lines laid down by Schott, Groedel, and Heinemann, and the treatment be not delegated to nurses. The latter should be carefully watched and supervised. I have seen in Nauheim even the gymnastic exercises given in a most slovenly fashion, the important elements of slowness in the movements and rest between them being entirely overlooked by the nurse.

In all procedures connected with physical therapy, especially hydrotherapy or gymnastics, a correct technique is all-important. Therefore it is far better to follow the prescribed rules of an expert like Brand in typhoid fever or like Schott in cardiac diseases, than to assert one's independence of thought by deviating from it to the detriment of the patient. (See article on Heart Disease.)

THE PRESENT TREATMENT OF TUBERCULOSIS.

By S. EDWIN SOLLY, M. D.

In consequence of the discovery by Koch of the tubercle bacillus as the central and constant factor of tuberculosis, there arose a method of treatment by drugs which aimed at the direct destruction of the bacillus in the tissues. During the past ten years a hundred or more different substances have been used to effect this purpose, introduced through the mouth, bowels, respiratory tract, skin, or directly into the lungs through the thoracic walls. With comparatively few exceptions favorable results were at first reported, but at the present time most of these treatments have been abandoned as unsatisfactory, and none are now endorsed and used in the chief hospitals and sanitaria. Experimenting, however, still continues with the view of finding a chemical specific for tuberculosis, but there is only one of these drugs whose use is still popular and widespread, and that is creasote.

While there is a broad consensus of opinion that, under certain conditions, creasote is a valuable aid in arresting tuberculosis, it is almost universally conceded that it is not a specific; and, indeed, experiments have proved this to be the case.

The announcement by Koch of the antitoxic quality of tuberculin was the beginning of the various and interesting experiments with different ingredients of tuberculous matter to which are ascribed, with more or less proof, anti-tuberculous qualities. The crude tuberculin, introduced by Koch and at first used extensively in all parts of the world, has now been abandoned in consequence of the death and disaster which resulted from its administration; though it must be admitted that occasionally this treatment has apparently caused a remarkable arrest of the disease. It is stated that the tuberculin now used is purged of its dangerous components and is diluted, and it is certainly given with more discrimination and care than was the case on its first introduction. Experiments are still being carried on with the various modified tuberculins, and excellent results are reported by some physicians, but the remedy is not received with confidence and support except in a few instances, either by the leaders or by the rank and file of the profession. The value of the evidence

in its favor is often obscured by the commercial element which is not unfrequently associated with its application. Another cause which clouds a just estimate of its merits is the fact that its use at the present time is generally limited to a selected class of cases, viz. those in an early stage, which are non-febrile, and which show very slight reaction to the tuberculin injections. In short, they are usually cases in which the prognosis is favorable under ordinary good general hygienic treatment. Again, the majority of these cases is treated in sanitaria, in which institutions, as the writer has shown by statistics, the general percentage of improvement is higher than in open resorts, whose climates are not markedly superior, so that this has often to be taken into account among the reasons for improved results. Moreover, the results share in a measure the higher percentage of improvement always reported, for a time at least, in regard to all new modes of treatment.

Why the first reports of new remedies, many of which are diverse in character, should so commonly be favorable it is not easy to explain. There are, however, certain points in connection with the exhibition of these therapeutic measures which demand full consideration in all attempts to solve the problem. Tuberculosis is for the most part a chronic and slowly advancing disease, whose prognosis is generally gloomy, especially in the minds of the laity, while the usual methods of regulating the diet, exercise, habits, and climate for the tuberculous patient have a sameness, lack of novelty and sensationalism, and consequently, under the régime laid down to the consumptive,

> "Life is as tedious as a twice-told tale
> Vexing the dull ear of a drowsy man."

This lethargy reacts upon the physician, and there is a deadly dulness all round; but—infuse the physician and the patient with the excitement that comes from trying some new and highly vaunted remedy, and presto! the scene changes: hope springs eternal in the human breast, and all is animation and bustle, and if the physical difficulties are not insurmountable we may witness the triumph of mind over matter and see the tide set toward recovery. The less that is known of the remedy the better the chance that the psychic force will prevail, for there is no truer adage than *Omne ignotum pro magnifico.*

Tuberculosis, as is conceded, most often attacks those of a nervous temperament, over whom mental impressions have the greatest power, and in whom, for the most part, there has been some depression of nerve-force preceding, causing, and also resulting from, their illness.

Improvement may be due not only to these various mental influences upon the physician and his patient, but also because, being mutually aroused, they turn all their thoughts and energies toward

a cure, and in consequence the doctor sees his patient frequently, keeps up his hope and courage, inquires more particularly into his daily life, and even into the condition of his bedroom and his wardrobe—most important details, too often neglected; while the patient, believing that his efforts, if continued for a few months, will bring him health, remembers his medicine, obeys instructions, and foregoes forbidden pleasures. Thus there is a hearty co-operation in using the far-off rivers of Abana and Pharpar instead of the languid interest shown in taking a bath in homely Jordan.

Sometimes, of course, there is scepticism exhibited by one, or both, as to the results of the remedy, but in spite of this there will still remain the element of an aroused attention to general hygienic measures, and a mind stimulated and therefore ready to receive impressions; and, further than this, we know that the reaction from scepticism to belief is often rapid and complete as soon as the first impulse toward it is felt.

Moreover, the element of suggestion, which undoubtedly affects the patient in a greater or less degree, is frequently present.

It is also too true that the element of cupidity has sometimes a powerful influence upon the honest weighing and reporting of the evidence of the physician.

Thus we see that many causes conspire to give an apparent value to remedies which time and experience do not confirm. These and similar considerations are, however, by no means arguments against the careful, intelligent, and scientific experimentation for specific, or new and improved, methods of treatment; nor can it be denied that, in certain instances, specific treatment appears to have accomplished its purpose, or, at least, to have given hope of future success. However, the evidence of the value of specific therapy, as a whole, has not been taken with sufficient breadth and care, nor for a long enough period, for us to decide upon a treatment from practical demonstration.

While the study of the causes, nature, natural history, forms, and variations of tuberculosis has rapidly advanced during the last few years, yet the knowledge thus gained is still too imperfect to allow of our founding upon it a positive specific germicidal treatment. We are yet in ignorance of what is the best point of attack—the bacillus tuberculosis itself, the toxins it develops, or the streptococci and kindred micro-organisms which accompany the later development of the disease.

Tuberculin.

The action of antitoxins in tuberculosis, as in other germ-diseases, is still shrouded in mystery; it is not yet known whether, when antitoxins act favorably upon a disease, it is through direct destruction of the germs or through a stimulating, alterative, or educational influ-

ence upon the leucocytes, phagocytes, or other germicidal constituents of the body.

It has been demonstrated that injections of tuberculin will destroy much and sometimes all of the ulceration of lupus, but there generally remains more or less cicatricial material in which bacilli are still found and which needs surgical treatment before healing takes place.[1]

From this fact it would seem that the tuberculin has power to destroy tuberculous masses, but only imperfectly to affect those which are imbedded in the fibroid and inflammatory defences raised around the ulcers. For this and other reasons the tuberculin treatment of lupus has been practically abandoned. Clinical experience, and the results of autopsies in cases of pulmonary tuberculosis which have been treated with tuberculin, strengthen these opinions concerning lupus. While the evidence is in favor of the power of tuberculin to destroy tuberculosis when it can be brought in contact with it, it can readily be understood from the ocular demonstration furnished by its use in lupus how, in pulmonary tuberculosis, much of the tuberculous mass is inaccessible to its action, and this accounts in a measure for its failure. Of course, even if the existing tuberculosis is all destroyed by the antitoxin, there is still the soil in which it grew to be regenerated, and the tendencies and weakness of the individual to be rectified. Liebreich[2] asserts, and in this he is supported by Hausemann and Saalfeld, that hypodermic injections of cantharidin will cure lupus without leaving cicatrices. It is also asserted by Abraham, Bramwell, Lake, and, more recently, by Barclay,[3] that thyroid injections have the same effect.

It would appear probable that antitoxins such as tuberculin do not act directly upon the special poison, but indirectly, through their stimulating influence upon the germicidal qualities of the tissues or blood, or by conferring an insusceptibility upon the cells. The strongest evidence of this is perhaps afforded by Calmette's[4] experiments upon snake-poisons. Both he and Fraser have extracted an antitoxin from snake-poisons, and have rendered animals immune by inoculations with it, prior to, coincident with, or even subsequent to, the injecting of the poison. Immunity was also secured if the antivenin was first mixed in a certain proportion with the venom, and the mixture thus formed injected. Fraser concludes that a chemical substance is produced in the blood derived from the venom. Calmette, on the other hand, believes the immunity is due to a sort of immediate insus-

[1] Koehler, *Berlin. klin. Wochenschrift*, 1894, p. 845. Carrucio, *Clin. dermo-sifilopatica della Università di Roma.* Malcolm Morris, *British Medical Journal*, June 3, 1893, p. 1154.

[2] *Berlin. klin. Wochenschrift*, April 8 and 15, 1895.

[3] *British Medical Journal*, Oct. 24, 1896.

[4] *Ibid.*, Oct. 3, 1896, p. 910.

ceptibility of the cells of the body in respect to the venom; his reason being that if the mixture of venom and antivenin is heated at 80° F. before injection, poisoning results, the antidotal power of the antivenin being destroyed. So the probable theory is that an antitoxin acts, not directly on the poison, but on the tissues or blood. It was shown by Fraser that the portion of the antivenin necessary for immunity was least when a mixture was injected, that it increased when the antivenin and the poison were administered separately, and was still greater in proportion to the length of time allowed to elapse between the injections of the poison and the antivenin. Kanthack writes: "Artificial immunity therefore depends neither on a direct germicidal nor on an attenuating power acquired by the serum and fluids of the protected animal." As evidence in favor of this belief he points out how Buchner[1] shows that a mixture of a toxin and an antitoxin which was harmless to mice was poisonous to the more susceptible guinea-pigs, showing that the toxin had not been destroyed but only placed in relation to a force which acted in antagonism to it when they were together brought to bear upon the tissues of the animals into which these fluids were injected.

It is undoubtedly true that treatment with the early, crude tuberculin was dangerously destructive, generally carrying the disease beyond its original limits, and increasing ulcerative and suppurative processes; and this the writer's experience confirms. On the other hand it would appear as if, in the modified tuberculin, the destructive element had been eliminated and possibly the immunizing property retained, unless, indeed, it may be that the tuberculin has only been diluted into inertness, and that the favorable results obtained are simply those which would usually follow upon the general good care of as equally highly selected a class of cases as those which are now usually reserved for tuberculin treatment. It is but just, however, to say that so careful and unprejudiced an observer as Trudeau believes that he has proved by experiments upon animals that immunity can sometimes be obtained from the use of tuberculin, and the evidence he gave to the writer was certainly favorable to this conclusion.

Dr. Sandberg, surgeon to the Bergen Hospital, in a valuable article entitled "The Use of Tuberculin in Surgical Diagnosis,"[2] after detailing a number of cases of surgical tuberculosis treated with tuberculin, sums up as follows: "If we now summarize the results of the treatment with tuberculin in these cases, it is at once clear that tuberculin is a reliable diagnostic agent in surgical tuberculosis; but with regard to this there has been heretofore no difference of opinion—the dispute has been regarding the therapeutic value of the remedy. My opinion

[1] *Allbutt's System of Medicine*, vol. i. p. 570.
[2] *British Medical Journal*, Oct. 17, 1896, p. 1109.

is that in my cases the results obtained might have been reached equally well by any mode of treatment. I dare not, in any special case, blame the tuberculin for the bad result, as the patient who now feels best was the one injected with the greatest quantity, in all about 130 mg.; he looks remarkably well and is quite stout. I do not, as said before, attribute this to the tuberculin, but think it proves that the remedy need not necessarily have any injurious effects, either locally or generally. But, in my opinion, its diagnostic value in the tuberculous joint-diseases is proved. As, however, it cannot be proved to possess any curative power in the treatment of tuberculous joint-diseases, it ought to be struck out as worthless. As an exception it might in certain other cases of local tuberculosis, such as the one instance of epididymitis mentioned above, have some significance in a therapeutic respect, otherwise its value is only as a diagnostic."

The prevention of the establishment of a disease, and its cure when established, are different matters; and results obtained from inoculated animals, in which the disease is an acute affection, are different to what may take place in a chronic disease—which human tuberculosis usually is; so that, while the experiments with tuberculous antitoxins are sufficiently encouraging to warrant their continuance, it is undoubtedly true that the use of tuberculin in practice is as yet of doubtful value and is still only experimental. These experiments are too numerous to allow of separate discussion here.[1]

Seropathy.

Seropathy began to be used in the treatment of tuberculosis when it first appeared as if the use of tuberculin had failed. Dr. E. Maragliano, of Genoa, first described his serum treatment to the British Medical Association, in London, in 1895.[2] He used a serum which, he stated, was free from bacilli, but contained their poisonous extracts. With this, by progressive vaccinations, he immunized dogs against tuberculous injections, and he demonstrated that, if he injected tuberculin accompanied by immunized serum, no reaction took place, but it did so when the tuberculin alone was used. He treated 82 cases of pulmonary tuberculosis in human beings, with favorable results. He pronounced the treatment to be harmless and usually beneficial. The chronicity of the case is not necessarily against success, but mixed infection generally is. Later he has written[3] that if he first destroys the germicidal power of the serum by heat, and then mixes it with tubercle bacilli, the resulting fluid will produce tuber-

[1] For further information see *Year-book of Treatment*, Lea Brothers & Co.

[2] *British Medical Journal*, xi. p. 444.

[3] *La Presse médicale*, 1896, No. 47, p. 273; *Il Policlinico*, 1896, No. 10, p. 213.

culosis on inoculation, whereas, if the serum be not heated, inoculation will fail.

Dr. G. H. Roger, at the Third French Medical Congress, in commenting upon Maragliano's experiments on tuberculous animals (whereby he cured 16.26 per cent. and had improvement in 48.5 per cent.) says that the course might be different in a diseased man from that in an inoculated animal, as in the former, anti-intoxications and other influences would come in. He also referred to the results from the use of Marmorek's anti-streptococcal serum as being too diverse as yet to tend toward definite conclusions.

Maragliano[1] further reports on the use of serum in human pulmonary tuberculosis, and from these reports the following table has been compiled by the writer, showing the quality of the cases and the results. He repeats his previous statements in regard to the harmlessness of the treatment, and urges its early use.

TABLE.

Statistics in regard to the use of Maragliano's serum.	No. of cases.	Apparently cured.	Markedly improved.	Stationary.	Worse.	Percentage of improvement.
1. Destructive broncho-pulmonitis with cavities. With fever 129; fever disappeared in 55	168	14	75	50	29	53
2. Destructive broncho-pulmonitis without cavities but with microbic complications. With fever 94; disappeared in 54	127	12	71	35	9	64
3. Diffuse febrile broncho-pulmonitis with and without destruction of tissue. Fever disappeared in 107	220	10	121	67	22	59
4. Diffuse apyretic broncho-pulmonitis with and without destruction of tissue	68	2	54	12	0	82
5. Circumscribed febrile broncho-pulmonitis. Fever disappeared in 69 cases	81	33	45	3	0	94
6. Apyretic circumscribed broncho-pulmonitis	48	33	13	2	0	92
Totals	712	104	379	169	60	68

In 74 per cent. of the cases fever was present. In 52 per cent. of these the fever disappeared.

496 of the cases were weighed, and 60 per cent. gained.

In regard to these cases the details of the treatment and general care which accompanied the use of the serum are unknown to the writer. He is also ignorant as to the permanency of the reported improvement, but these are very important points in judging of the value of the injections.

Richet,[2] after continuing his experiments with Héricourt upon animals, concludes that normal serum retards, and microbic serum prevents, the development of tuberculosis.

Dr. R. Paquin[3] of St. Louis reports on the use of his special

[1] *Gazetta degli Osp. e delle Clin.*, Oct. 18 and 20, 1896.

[2] *Soc. de Biologie*, Jan. 12, 1895.

[3] *Medical Record*, Sept. 19, 1896.

horse anti-tubercle serum, and the method of its production: 206 cases of human tuberculosis were treated, of which he says that less than 10 per cent. were early cases; 40 completely recovered, 110 sufficiently to return to work, and 76 did not improve or remained stationary, so that there was a total of 66 per cent. benefited.

Dr. L. B. Edwards[1] reported treating 14 cases with the Paquin serum. Of these 2 were desperate and died; 3 completely recovered; 6 improved, and 3 no longer declined; so that 64 per cent. were benefited.

Dr. Dunwoody of Cripple Creek reported on 4 cases treated with by him with Paquin's serum; 3 improved.

Dr. Bernheim[2] of Paris reported favorable results in 300 incipient cases treated with serum from immunized animals, but the time of reporting was too short to give the permanent results.

Rheumatic Virus.—Dr. Lanigan[3] treated tuberculosis by injecting blood-serum from rheumatic persons with favorable results.

Vaccine Virus.—Dr. Turiansky[4] reports favorable results with vaccine, as also does Tyndale.

Anthrax Virus.—Dr. Perroncito[5] found that cattle vaccinated with anthrax virus were immune to tuberculosis.

Anti-streptococcal Injections.

The fact has been recognized that the destructive processes of tuberculosis, at least such as are accompanied by ulceration, are due to the association of streptococci with the tubercle bacilli, and these are called cases of mixed infection. Marmorek, with a view to arresting these processes, has extracted an antitoxin from the virus of streptococci, and has succeeded in immunizing animals. Favorable reports of its use upon tuberculous human beings have been made, but, at present, nothing very definite is established. "The Relations of the Morbid Conditions depending on, or associated with, the Presence of Streptococci," is the title of an interesting article on this subject by Dr. G. H. Woodhead.[6]

The general conclusions concerning the antitoxic treatment which may fairly be drawn up to the present time are well expressed by Kanthack[7] in the following words: "The antitoxic treatment has hitherto been tried in man in several diseases, and a short summary of results may be acceptable at this point. Its success is so undoubted in diphtheria as to silence all opposition, and to lead us to hope for better and better results. It is a specific remedy, and it surpasses

[1] *Medical Record*, Sept. 19, 1896.
[2] *Sajous' Annual*, 1896, vol. i. A, 30.
[3] *Ibid.*, 1890, vol. i. A.
[4] *Year-book of Treatment*, 1893.
[5] *Ibid.*
[6] *British Medical Journal.*
[7] *Allbutt's System of Medicine.*

any other which has ever been employed for the treatment of this disease." He further says, however, "One serum after another has been vaunted as a curative agent in tuberculosis; the dog, the goat, and the ass have had false pretensions thrust upon them, and recently Maragliano has come forward with an anti-tuberculous serum, which, however, is evidently not a true antitoxic or immunity-conferring serum; it seems rather to act as a modified tuberculin, raising the temperature considerably on injection, and producing other physiological changes as a rule not observed with protective serums. Moreover, Maragliano's observations are not based on sound experiments; he fails, at any rate, to record any successful preventive inoculation of susceptible animals. Our great difficulties in tuberculosis are the protection of the individual from secondary infections, and the removal of the latter when they have once made their appearance."

Nuclein Treatment.

This treatment is founded on the theory first advanced by Metchnikoff, that the white blood-corpuscles act as phagocytes in destroying micro-organisms which are foreign and dangerous to the tissues, and it was with the idea of reinforcing this protective quality that the nuclein treatment was tried. Nuclein is the principal chemical constituent of the living parts of cells, and is the chemical basis of the nucleus. The nucleins used are obtained from blood-corpuscles, casein, egg, salmon sperm, and yeast. The experiments of Victor C. Vaughan of Ann Arbor, Michigan, tended to show that nuclein derived from polynuclear white cells is the germicidal constituent of blood-serum. This conclusion has been corroborated by McClintock and others. Huber has proved that nuclein injections increase the number of white corpuscles, chiefly of the polynuclear cells, that the amount varies with the individual, and that the increase is observed within three hours of the injection and disappears after forty-eight hours. It is established that more or less immunity can be obtained for animals against the effects of inoculation with such fatal germs as the diplococcus of pneumonia by previously and frequently repeated injections of nuclein, and the results are retarded if the nuclein injections shortly follow the poisonous inoculations. The results following injections of tuberculous matter are not so marked as in the case of most other poisonous inoculations. The process does not appear to be directly germicidal, but educational. No bad effects from its use are reported. The majority of experimenters believe it to be of avail only in early and limited cases of tuberculosis. Below is the summary of the latest results reached by Dr. Vaughan with which he has kindly furnished me:

"The cases reported in this and the preceding paper include all

those in which the tubercle bacillus was found, treated by me with yeast nucleinic acid, from May, 1893, to December, 1895. There has been no selection of cases to report, and no exclusion. Many were in the last stages of the disease when the treatment was begun. Indeed, some of these were at that time confined to their rooms and died within a few weeks. In my study of the value of yeast nucleinic acid in the treatment of tuberculosis, I have endeavored to carry out the investigation as I would a series of laboratory experiments, and, above all, not to deceive myself. Of the 76 cases reported, 70 are those of pulmonary tuberculosis. Of these, 30 ($42\frac{6}{7}$ per cent.) have died. Of these, at least 9 were temporarily benefited.

"Of the 70, 17 ($24\frac{2}{7}$ per cent.) have been continuously free from the bacillus for from nine months to two and one-half years, so far as can be determined from the sputum. That is, either there has been during this time no sputum to examine or that examined has failed to reveal the bacillus. To the best of my knowledge, another has been free from the bacillus for more than a year, and another has been free from the bacillus with the exception of a short time, and still another was free when last examined.

"20 ($28\frac{4}{7}$ per cent.) were still infected at the last examination. Of these, 16 have been apparently improved by the treatment.

"It should be stated that none of these were hospital cases. I was not able to control their diet. Most of them were in moderate circumstances and had only inexpensive food. The hygienic conditions under which many of them have lived have not been satisfactory.

"I have reached certain positive and definite conclusions concerning the value of the 1 per cent. solution of yeast nucleinic acid, administered daily in doses of from 60 to 80 minims, hypodermically, and these conclusions I will now give:

"1. In advanced stages of the disease, in which the area of involvement is large, with or without cavities, the best that can be expected from this treatment is temporary improvement. Even this does not occur in all cases.

"2. In initial cases, when the area of infection is limited, this treatment may, and often does, not only arrest the progress of the disease, but it acts as a curative agent."

In connection with the part played by the leucocytes in tuberculosis the account of some recent researches by Stein and Erbmann are interesting. Their conclusions after examining 60 cases of tuberculosis were in brief as follows:

Stein and Erbmann state that the number of the white cells is normal in initial phthisis, but after hæmoptysis there is temporary moderate leucocytosis. It is marked in cavitations, in chronic sup-

puration following caries, in final exudative processes, and in hyperplasia of lymph-glands. If the other conditions mentioned do not exist and yet leucocytosis is present, the diagnosis of a cavity may be made. In all other conditions leucocytosis is absent. The cause is a secondary infection, a septic process which may be the result of various bacteria.[1]

Whether the successful results obtained in patients undergoing the nuclein treatment are due to these injections, and not solely to some one or other of the general causes spoken of in the beginning of this article, it is yet too soon to say. Granting, however, that they are the cause, we must be still in doubt as to why they act beneficially—whether as nucleins, or as phosphorus injections, or in some other unknown way.

Antiseptic Treatment.

Dr. J. E. Squire, physician to the North London Hospital for Consumptives, writes, concerning the use of antiseptics in tuberculosis, substantially as follows:[2]

If you estimate the average amount of blood as one-thirteenth of the body-weight, a man weighing 130 pounds would have 10 pounds of blood in his system; so that, to make a 5 per cent. solution, there must be half an ounce of an antiseptic dissolved in the blood, and this would have to be frequently renewed. Holscher has shown that this cannot be done, although both he and Cornet procured partial immunity in guinea-pigs by creasote injections.

However, the active tubercle bacilli are, for the most part, surrounded by inflammatory products which block up the blood-vessels, and therefore they cannot be reached by antiseptics through the blood. He goes on to say that antiseptic inhalations can modify the condition of the tubes, and mitigate the virulence of the secretions coming from the foci, and so prevent disease from spreading to the other parts of the lungs; at the same time they diminish the influence of the streptococci and other poisonous bacteria. He says that, theoretically, he believes that antiseptics cannot cure the disease, and with this his clinical experience is entirely in accord, but they may do good by lessening hectic, etc., through affecting the streptococci.

In a discussion on a paper by Dr. J. W. Moore of Dublin at the meeting of the British Medical Association, August, 1896, the consensus of opinion seemed favorable to general hygienic measures, and not to specific treatment. Creasote, however, was favorably spoken of by the majority.

It is impossible to consider in detail the numerous antiseptics which have been recommended in the treatment of tuberculosis, and

[1] *Deutsches Archiv für klinische Medicin*, 1895; see *Medical Record*, July 25, 1896, p. 123.

[2] *British Medical Journal*, Jan. 25, 1896, p. 208.

regarding which favorable clinical reports are given. So far it has been the history of an enthusiastic début upon the therapeutic stage, a short appearance and then retirement into obscurity, followed by the ushering in of another drug which repeats the experience, and so on *ad infinitum*—a passing show. While it appears possible to the writer that some of the antiseptics may in time win a permanent place in the treatment of tuberculosis, the evidence of their merit, except in some few instances, where they act favorably upon certain symptoms, has yet to be proved, and, assuredly, as the disease is at present known, it is scarcely rational to expect to find a chemical specific. Of the drugs that entered the field as such, there is, however, one whose prolonged and widespread use and reputation deserve fuller consideration, and that is creasote.

Creasote continues to be extensively used. The majority of reporters do not believe that it is a specific, but consider that better results are obtained when it is used in addition to general hygienic, tonic, and nutritive measures.

Theories of its Action.—Of the theories put forward to explain the mode of its assumed beneficial influence, the most usual are that it acts as an antiseptic and stimulant to the digestive tract, that it benefits the catarrhal condition of the respiratory tract, while Audeon and others consider that its action is one which may be called "substitutive irritation," and they believe that it especially promotes fibrosis around the tuberculous masses.

Suitable Cases.—The preponderance of opinion is against its use in febrile, acute, florid, or erethic cases. Some authorities, such as S. Solis-Cohen, claim, however, that it is markedly beneficial when there is fever or breaking down of tissue, as well as in catarrhal conditions.

Dosage.—During the years first following its introduction it was considered that the drug should be pushed to the utmost limit of the patient's endurance, and the amount taken was often enormous, but now the majority of physicians are in favor of moderate doses.

Method of Administration.—Creasote is given through the mouth in the greatest number of cases, and perhaps most frequently in the form of capsules, though many adhere to the earlier method of administering it in wine. The method of administration by capsules has gained ground of late years because of the fact that, as creasote not infrequently provokes irritation of the gastric mucous membrane, the capsules containing it are now usually coated with keratin, which is stated not to dissolve until it comes into contact with the juices of the intestines. To avoid its action upon the stomach Audeon and others give it by enemata. It has also been used quite extensively by subcutaneous injection; this plan has been markedly successful in

reducing the fever, but the method is somewhat painful. The rubbing of guaiacol on the surface reduces the temperature in a pleasanter manner. Injections around tuberculous areas have been used in surgical tuberculosis, and Chappell reports good results by this method in laryngeal tuberculosis. Inhalations of creasote are still resorted to, but as they are frequently irritating, blander antiseptics are beginning to be more generally used.

Personal Experience.—The writer, by reason of his practice in a health-resort to which patients come from all parts of the world, has had unusual opportunities of studying the use of creasote in a variety of persons. He finds that the majority of patients when they arrive in Colorado are taking creasote by advice of their home doctors, though it would seem as if creasote was not quite so popular with the leading consultants as formerly, and the dosage is markedly reduced. It has been the custom of the writer, unless there are evident reasons for an immediate change, such as gastric irritation, to instruct these patients to continue with the creasote, but to report promptly as soon as they are not feeling well; this advice has been given guardedly so as to avoid showing any apparent connection between the creasote and possible future symptoms. The result of this course has been that the majority develop sooner or later more or less gastric irritation, unless they are taking very small doses or have unusually good digestions, the febrile cases being the soonest affected. Whether there is possibly an increased hyperæsthesia of the gastric membrane, through the greater energy of the vascular and nervous systems which is apparently more or less induced during the stage of acclimatization to a high altitude, particularly in delicate persons, it is impossible to say. If this theory be correct it would be simply due to local causes; the writer's experience is corroborated by that of the majority of his colleagues. On the other hand, it may be that if the evidence of cases treated for as long a time at sea-level was taken widely, it would confirm the Colorado experience. While it is not possible accurately to compare cases, particularly in private practice, because the life and environment is so varied, yet the writer's impression is that in the same quality of cases, in Colorado, those who do not take creasote do at least as well as those who are under the creasote-treatment. This, of course, is leaving out patients to whom it is given beneficially for fermentative dyspepsias or bronchorrhœas.

There are some reasons which may serve to explain why the reports of the use of creasote should be so favorable. These are that the cases in whom the creasote-treatment is continued are usually those with a strong digestion, the feeble ones being generally dropped off the roll so early that they are not counted, and again, the same may be true of the febrile cases—that they are usually omitted from

those chosen for the creasote-treatment, or the treatment is abandoned in these cases in so short a time that they are not counted in the results; therefore, if it be true that the majority of cases are persons of good digestion and without fever, the creasote cases are a highly selected class in whom the percentage of results will naturally be higher than the average.

However, creasote is occasionally very valuable for certain symptoms in the tuberculous as in other invalids, and it often confers the mental benefit which patients generally derive from any definite and systematic treatment upon which they can anchor their hopes, and which gives them a reason for being watched by a physician.

Space will not allow of discussing separately the numerous antiseptics that are still used, and for which are claimed curative properties in the treatment of tuberculosis. Of these cinnamic acid, oil of cloves, and peppermint, are among the most recent. Most of these remedies are administered hypodermically, by which method, no doubt, the influence of the drug, whatever it may be, is brought to bear more surely and directly upon the blood than by any other means. But, granting better results by hypodermic injections, it is only fair to bear in mind the increase of the mental impression that is brought about by this definite and mechanical and more or less unpleasant form of medication, and to consider how far this may influence results.

Non-specific Treatment by Drugs.

With respect to the drugs used in the treatment of tuberculosis other than those for which specific action is claimed, they may be divided into two classes: those which are exhibited for their presumed beneficial effect upon the general condition, and those given to combat special symptoms.

As anæmia is usually more or less present in tuberculosis, iron, arsenic, and quinine are commonly of benefit as blood-tonics, and of these arsenic is especially popular, and, in the writer's opinion, deservedly so. Whether this favorable regard is mainly due to the general alterative action of the drug, and to its reputed selective affinity for the pulmonary tissues, can only be surmised; but the writer believes that, where anæmia is present, with or without pyrexia, or if breaking down is going on, or when fibrosis is a danger, arsenic is especially valuable. Where hectic fever exists, a pill of arsenous acid, gr. $\frac{1}{50}$ to $\frac{1}{20}$, with ferrum pyrophosphate gr. ij and strychnine sulphate gr. $\frac{1}{40}$ to $\frac{1}{15}$, in pill or capsule, t. i. d. p. c., has appeared to do good service: both the arsenic and the strychnine being administered at first in small doses and then cautiously increased. Quinine in 2-grain doses for appetite is generally better given before the meal, or, instead, one of the pleasant preparations of calisaya, with which may be com-

bined either an alkali or an acid according as the digestion is unduly acid or alkaline. In cases of defective digestion it is often best to give the arsenic before the meals with an alkali and calisaya, in which case one or two minims of Fowler's solution appears to act as a gentle stimulant to the gastric membrane, and the after-dinner pill is postponed till the digestion is restored. Quinine is also often useful in variable doses from 5 to 20 grains to limit fever, being then given some hours before the afternoon rise.

As has already been said, there is in the majority of cases of pulmonary tuberculosis more or less depression or irregularity of the nervous system, and there is no doubt that strychnine or nux vomica given in increasing doses to the point of tolerance vies with arsenic for the first place in the list of drugs useful in phthisis. When strychnine, or preferably nux, is given for appetite, it is taken with most advantage in a small dose before meals, but if it is used only as a nerve-tonic, and in large doses, it is best borne after meals. In cases where the tone of the nervous system is depressed—and they are very common among consumptives—there is usually no nerve-tonic equal to strychnine, and the writer fully endorses its use as prescribed by Dr. T. J. Mays, who writes thus:

"Begin with a moderately small dose of the drug, gr. $\frac{1}{30}$, four times a day; give this for one week, then increase it to gr. $\frac{1}{24}$ for another week; during the next give gr. $\frac{1}{20}$; the following week raise the dose to about gr. $\frac{1}{16}$; and so on, making a slight increase every week until you observe nervousness, restlessness, or twitching of the muscles—the signs of the beginning of strychnine-intoxication. In most cases these symptoms do not develop until gr. $\frac{1}{12}$ or $\frac{1}{8}$, or even a larger dose, is reached. It must be understood that the drug is to be given in these doses four or even five times a day. The object is to impress the nervous system with the full stimulant effect of this drug. The sooner this end is attained the better will it be for the patient. For this reason you begin with small doses and work upward as rapidly as you can with safety. After the desired point has been reached the question arises whether it is better to continue the largest dose or to resume the original. I think it best not to vary from this line during the remainder of the treatment, for you do not wish to lose what has been accomplished. Keep the strychnine-treatment up to the highest level of safety, but shun the point where the stimulus extends into the region of tetanus and of paralysis. It is best, however, to reduce the dose somewhat at this point. If, for example, it is found that gr. $\frac{1}{8}$ is a maximum dose reduce to gr. $\frac{1}{16}$, gradually increase the dose again until gr. $\frac{1}{8}$ is reached, and then return to gr. $\frac{1}{16}$ or $\frac{1}{12}$. After you have increased and decreased the dose several times, you will probably find that gr. $\frac{1}{8}$ no longer produces any dangerous

symptoms, and that you now can give as much as gr. $\frac{1}{6}$. When administered in this way the drug may be given for an indefinite period to the majority of phthisical patients.

"The remedial effects of the drug show themselves in various ways. The nervousness, sleeplessness, and pain in the chest will be ameliorated and perhaps entirely disappear; the cough, expectoration, and dyspnea will diminish; vomiting will abate; the appetite improves; the patient gains in flesh and color; the weak and rapid acting of the heart will become slower and stronger; the red corpuscles increase in number, and the patient becomes more hopeful and brighter."[1]

Zinc and phosphorus are also of service, especially the former, when night-sweats occur. Gold and manganese, when given hypodermically, are highly recommended,[2] but the writer has not been favorably impressed by his experience of this treatment.

In considering the drugs serviceable in the relief of special symptoms, we can only glance at them briefly.

Cough.—The dry, hacking cough which usually appears in the stage of tuberculization, being useless and generally caused by the nervous irritability of weakness, is best cured by nerve-tonics, with as little sedative as possible; codeia is generally the most satisfactory sedative, and this, if possible, should be reserved for bed-time, given in doses from gr. $\frac{1}{4}$ to gr. j. When the secretion is scanty Dover's powder gr. v–x can be substituted. Demulcent lozenges, etc., in moderation, may suffice during the day. The character of the cough sometimes shows its origin to be in the upper air-passages, especially in hypertrophy of the various tonsils, and then local treatment may remove it. The numerous causes of and remedies for cough are admirably discussed by Dr. Beverley Robinson.[3] The cough which is accompanied by expectoration should be treated as little as possible, unless it exhausts the patient or interferes with eating or sleeping, when stimulating expectorants are of service. It has been pointed out by Dr. C. T. Williams that aromatic spirits of ammonia in drachm doses given early in the morning will assist the difficult and prolonged expectoration from cavities and enlarged bronchi. It is often of great service for the patient to lie over in the position that is found to best favor expectoration, and to cough freely before sleeping and on rising. Hot milk or soup taken at these times is also an aid.

Fever.—The specific use of drugs for the amelioration of this symptom should be very limited and temporary, which means that

[1] *Journal of the American Medical Association*, Oct. 10, 1896.

[2] See J. Blake White, and Shurly and Gibbes.

[3] *Trans. of the American Climatological Association* for 1896.

the underlying causes ought to be attacked and direct treatment by drugs left alone or used only in emergencies.

"The Rôle of Fever" is the title of an admirable paper by Dr. H. A. Hare[1] in which he argues that it is primarily a beneficent process, and he gives the rational basis from which to treat it.

When general treatment by tonics, rest, food, bathing, and fresh air fails to bring the temperature of the patient down so that it is no longer a distress to him, or before their influence is fully felt, one or other of the coal-tar antipyretics can be used beneficially, if guarded by caffeine or quinine (gr. i–ij), for a few days or weeks but rarely longer. These drugs should be given two to four hours before the maximum rise, when a small dose will generally suffice and depression be avoided. In this way the patient is often enabled to eat and rest better and so gain strength, and time is afforded for the general treatment to become efficient, after which it is best to drop these direct remedies. There is, however, one drug whose influence on temperature, when given in large doses, appears to be specific, and which can be used for a prolonged period with benefit in certain cases where the pyrexia is persistent; and that is alcohol, whose effects will be discussed farther on.

Dyspepsia.—The experiments that are reported by Dr. E. M. Skeritt in the *Year-book of Treatment* for 1896, p. 60, throw some light upon the causes of dyspepsia, and particularly upon loss of appetite, in consumptives. A *post-mortem* testing of the pancreatic juice showed that its fermentative power was reduced, in 50 per cent., below that of the juice found in healthy persons who had died suddenly. The gastric ferments were not investigated.

The saliva of living consumptives was tested and found to be markedly deficient in 50 per cent. of the cases. For these reasons Dr. Skeritt doubts the advisability of stimulating the digestion, and prefers to give digested foods or acids, such as malt extracts. In noticing this he mentions the investigations which have been made upon atrophy of the gastric glands. The writer believes that practically the point is a good one, and should be recognized when stimulation fails to have a good effect.

Diarrhœa.—The treatment for this complication is very clearly given in Vol. I. of this SYSTEM (page 921). The writer's experience has been that in diarrhœa, especially when due to tuberculosis of the intestines, a large dose of bismuth subnitrate, gr. xx–lx, given before each meal, in combination with salicin gr. v–x, is generally the best remedy. To this may require to be added an opiate at night, such as Dover's powder gr. iv–viij or chlorodyne ♏x–xxv. When the stools are offensive creasote gr. iij given in the form of

[1] *Therapeutic Gazette*, February 15, 1896 p. 98.

an enteric pill two hours after meals is often of service. In some cases of chronic diarrhœa arising in the course of tuberculosis, especially when dysenteric in character, instead of these remedies success often attends the administration of liquor arsenicalis ℥ij, tinctura opii deodorata ℥ij–v, in water before meals. Sometimes when the diarrhœa is dependent on ulceration in the rectum, cauterization of the ulcers will assist a cure.

Vomiting.—In addition to the advice given by Dr. Cohen, attention may be called to the importance of encouraging or diminishing expectoration in such a way, as regards the time of its occurrence, that the cough does not interfere with meals. This can be brought about by the judicious use of sedatives or expectorants, or provoking the expulsion of the sputa by having the patient lie down, in the position in which he coughs and expectorates most readily, an hour or more before food is taken. When the coughing is reflex with but little expectoration a previous dose of a sedative, such as codeia gr. $\frac{1}{8}$ with ingluvin gr. v, after the meal, is often the best treatment. The character of the meal should be simple and digestible.

Hæmoptysis.—Opinions differ greatly upon the correct treatment for hæmoptysis. Valuable light was thrown on this subject by a discussion held at the last meeting of the American Climatological Association, May, 1896, and in the *Transactions* for that year will be found a summary of the views upon this subject held by the leading physicians of New York, Philadelphia, Boston, Chicago, and Colorado Springs.

Rest, both mental and bodily, was almost unanimously recommended, and the administration of opium in some form or other was shown to be about equally popular. Ice was, perhaps, the next favorite on the list. Saline cathartics then followed, after which came ergot, and next astringents. The ligation of the limbs and counter-irritation found a few advocates. The general conclusions to be gathered from this consensus of opinion were that the use of ergot was declining, apparently chiefly on theoretical grounds, and there was exhibited, on the whole, a scepticism concerning the value of all drugs in hæmoptysis except opium. As setting forth the writer's own views on this subject some of his remarks in the above-mentioned discussion will be quoted:

"The fact is, we are in an unfortunate position about the treatment of hæmoptysis. Our practice must be almost purely empirical, because we are ignorant of the physiological action of the pulmonary circulation and the direct influence of drugs upon it. The observations that have been made by physiologists are as yet incomplete. Dr. Bradford has made the best researches upon the subject. When the blood-pressure is raised in the aorta, is it also raised in the pul-

monary artery? We do not know. The question is still unsettled. So I do not think we are in a position to decide about the relative value of remedies upon theoretical grounds. As the facts are unknown, we can only use our practical experience in the treatment of pulmonary hæmorrhage.

"We are all agreed upon the importance, in serious hæmoptysis, of rest in bed, rest to the chest by strapping, and rest to the system by opiates; these are the first essentials of treatment, to which may be added another, alluded to by previous speakers, that of quieting the nervous agitation of the patient. The nervous phenomena connected with hæmoptysis are very marked, particularly the mental. Next, we all probably rightly attach a certain secondary value to such treatment as stimulating applications over the liver or mustard-baths to the feet, and to purgation.

"In estimating the effect of our remedies in the treatment of hæmoptysis we often do not know when we do good and when we do not, because most hæmorrhages tend to stop of their own accord, without intervention of the physician and the application of remedies.

"Cases of hæmoptysis may be divided broadly, as has been said, into those which are the result of congestion and capillary bleeding, and those which arise from erosions of arteries. Each, theoretically and practically, requires a difference in treatment, and I believe our success largely depends on our diagnosis of these conditions.

"The first great danger in profuse hæmorrhage from a large vessel is the drowning-out of the patient by the blood, and if the physician arrives early it is advisable to turn the sufferer in such a position that the blood can flow readily out of the mouth; to lay him down on the back in bed is to adopt the worst possible position when he is bleeding freely.

"As regards the application of ice to the heart, I am inclined to think that it is often beneficial. It seems to quiet the organ, and thus assist in checking the hæmorrhage. I am sceptical about the value of astringents, such as tannic and gallic acids, nor have I been satisfied with the effect of large doses of lead, as recommended by Williams.

"My clinical experience has been favorable to the use of ergot in large doses, given subcutaneously, at intervals of four to six hours in the twenty-four. I have in mind several cases of very severe hæmorrhages from large cavities, which were bleeding profusely until I used ergot subcutaneously, giving no other remedy. I believe a common cause of failure with ergot is its irregular and insufficient use and its administration through the mouth. Given under the skin, at regular intervals and in full doses, I consider it of great efficacy in arresting hæmoptysis, particularly if this be due to an eroded vessel, and in

the majority of cases I judge it superior to other remedies. There are, however, some cases in which ergot is absolutely useless. What the conditions are which account for this is mere speculation.

"I also regard atropine as an extremely valuable remedy in serious cases, particularly in those in which ergot has proved a failure. But it must be given hypodermically in large doses, such as $\frac{1}{50}$ of a grain. A small dose of atropine is not beneficial. Thus, morphine is best given without the usual $\frac{1}{150}$ of atropine. It is stated that small doses of atropine raise the blood-pressure, while large doses lower it. The reason that atropine is often successful in cases in which ergot is a failure may be that in certain conditions lowering the blood-pressure, as by large doses of atropine, is essential to success, though in certain other conditions raising the pressure is no detriment, or not sufficient to offset the other beneficial qualities of ergot.

"Opium in some form should always be given, as well as other suitable remedies, when it is desired to arrest the hæmorrhage and check cough. But there are cases of congestion in which it is unwise to do this.

"The immediate danger of suffocation and the risk of a subsequent pneumonia are the most important considerations in the treatment of severe hæmoptysis."

Tubercular Laryngitis.

Tubercular laryngitis is always a serious disease, and is almost invariably associated with pulmonary tuberculosis. Its presence appears to indicate a tendency to free dissemination of tubercle with but little tendency to self-limitation. While the disease may undoubtedly arise from local inoculation of an abraded laryngeal membrane, yet clinical and theoretical considerations make it probable that it usually arises from an extension from the lungs or glandular structures of the throat or thorax. The cases of spontaneous cure of this affection are extremely few, especially of the ulcerative form. Fortunately judicious local treatment can do much to mitigate, and it occasionally cures, the disease, and, although the patient may succumb to the tuberculosis in other organs, yet topical measures will sometimes arrest the progress of the laryngeal disease, so as to save the patient from a distressing death through an advancing tubercular laryngitis.

The first essential of the treatment is attention to what may be termed the toilet of the throat—that is, the cleansing and washing of the membrane with an antiseptic alkaline spray, such as Dobell's solution, and if necessary the use of a cotton swab, cocaine being first applied. Sedative and curative effects are best produced by stimulating, and sometimes by methods which are apparently harsh. The

condition is usually an anæmic one, and the congestion is chronic in character. The stimulation may range from that of a weak solution of nitrate of silver, ichthyol, or menthol, to cauterization with lactic acid or the scraping of the ulcerated surfaces with a single curette or even the excision of tubercular masses with the double curette as used by Krause or Heryng.

The submucous injection of creasote or lactic acid into tubercular swellings with the automatic syringe referred to under the head of Intra-laryngeal Injections is also of marked benefit. Iodoform mixed into a paste with glycerin may be applied on cotton to ulcerations after cauterization or scraping. A weak cocaine spray should be used before the introduction of instruments into the larynx. When the treatment is likely to be painful, a 20 per cent. solution of cocaine should first be applied to the parts ; pain at other times is best relieved by a 10 per cent. solution of antipyrin mixed with an equal quantity of a 4 per cent. solution of cocaine.

Alcohol.

Alcohol has been extensively used and abused in the treatment of tuberculosis, and physicians are frequently to blame either in denying its merits altogether or in prescribing it carelessly. As a routine practice the recommendation of alcohol in phthisis is to be condemned, and there is a large proportion of cases in which its use is harmful, or in which it should at least be only temporary. While much remains to be done in the study of the physiological and pathological effects of alcohol, these facts may be considered as established, viz. that moderate doses of alcohol act as a stimulant, improve the appetite and digestion, and increase weight, while large (not extreme) doses act as a sedative and antipyretic, idiosyncrasy modifying these phenomena very considerably. Persons of a nervous temperament or a full habit do not tolerate alcohol so well as those who are phlegmatic or thin-blooded. The taking of extra doses of alcohol or its prolonged free use leads to fibroid change and its consequent phenomena. The records of autopsies of chronic alcoholics appear to show that the fibrosis induced often arrests pulmonary tuberculosis, though it may have been disastrous in other directions.

Alcohol in any form is frequently prejudicial in the treatment of tuberculosis, particularly in women or in those who are in the habit of abusing it either continuously or temporarily. If the patient has been previously accustomed to its moderate use this may generally be continued with advantage, or, if he does not seem to respond to other treatment as readily as he should, alcohol may be cautiously tried. In some cases from a half to two tablespoonfuls of whiskey, with a bitter and in water, immediately before meals will start up an appe-

tite ; when this has been effected it is best either to omit the alcohol or to give it after instead of before the meal. At lunch and dinner it is often best borne in the form of wine or beer taken with the meal and it should not be taken at breakfast-time. When there is a weak heart and but little food can be digested at a time, alcohol is often administered with more benefit between the regular meals, but it should always be accompanied by some slight nourishment, as in the form of a milk-punch an hour before breakfast, or an eggnog, an egg-oyster, or a glass of wine or of whiskey and water with a biscuit between meals, at bed-time, or during the night. The administration of a moderate amount of alcohol divided into four or five doses and spread over the twenty-four hours as indicated, appears to act as a heart-tonic. When fever is distressing and prevails in spite of general treatment, the writer has found the administration of large amounts of alcohol, continued sometimes for three or four months, of great assistance in helping patients over a period of excavation, or for a shorter time, during a slowly advancing tuberculization accompanied by fever. As in all cases, but especially when alcohol is given, the urine must from time to time be tested and its quality estimated, while the nervous, hepatic, and digestive functions are watched. The initial doses should be small, and be cautiously and gradually increased to the point of tolerance. Alcohol used in these ways does not induce a habit, and when the need for it disappears, there generally arises rather a distaste for it. The danger is not in taking it according to rule, but in "nipping" on an empty stomach, in following inclination, or in using it to procure a ready stimulus before undertaking some unwise exertion.

The exhibition of large doses of alcohol with the view of directly procuring fibrosis around the tuberculous foci is most unquestionably dangerous, as there is every reason to believe that the same amount of fibrosis will occur coincidently in other organs, and kidney and liver disease be induced, or at least a troublesome and depressing lithæmia established. On the other hand, the presence of a mild gouty habit, either previously existing or created by the continued use of alcohol, if it does not interfere with the general health, appears to tend toward arrest of the tuberculosis, perhaps by moderately increasing the fibrosis. The form and amount of the alcoholic beverages used must depend upon individual tastes and tendencies ; the race and habits of the patient have much to do with the choice.

Alcohol administered at bed-time, especially a malt liquor, will often induce sleep, and a little whiskey and water taken with a small biscuit when lying awake during the night, will have the same effect.

Food.

Unquestionably the quality and quantity of the food supplied to tuberculous patients is of the utmost importance. This subject is so fully and excellently treated of, both practically and theoretically, in Dr. Cohen's article in Vol. I. of this System that the writer has but little to add. It is undoubtedly true that for the majority of tuberculous patients animal food should be the principal and in some instances almost the only article of diet, but the individual as well as the disease is to be considered, also the desirability of interesting the patient in his food by reasonable variety.

Milk is a valuable food for the consumptive, and if possible should be included in his dietary; but harm is often done by giving it in excess, particularly with a full meal, for it is digested with difficulty by certain so-called bilious patients. These persons can, however, often take hot milk if the cream is first removed, then lime-water, soda, or salt added, and it is heated without boiling, and given on an empty stomach an hour before a meal. Sometimes it is better to dilute the milk with an equal quantity of a pleasant alkaline effervescing carbonated water, such as Apollinaris or Manitou; or it may be necessary to peptonize it or give it in the form of buttermilk or koumyss. It is also often a good plan where coffee is not contraindicated to allow a small amount of strong coffee to flavor a bowl of hot milk at breakfast-time. Tea made with hot milk was a favorite recipe of the late Sir Andrew Clark. Milk is better digested if the oil-globules are first broken up as in a milk-shake. Cream apart from the milk and added to other articles of food or drunk alone, or flavored with a glass of Maraschino, is an attractive and nourishing beverage to some patients. Milk-punches are also useful, but not always easy of digestion.

Eggs swallowed whole and taken on an empty stomach an hour before meals are rapidly digested and stimulate rather than diminish the appetite. Cooked eggs are much slower of digestion than raw, but if digested are valuable articles of diet. Some patients cannot, however, digest the yolk, in which case the white, uncooked, should be taken alone or added to other food.

Beef is generally thought in this country to be more nourishing than mutton, and this is true of most of the mutton obtained in America, but in England, where the sheep are raised for food as well as for wool, mutton is undoubtedly the equal of beef in food-value and digestibility. When the patient is weak and with poor digestion it is always advisable to give food before rising in the morning, in the middle of the forenoon and afternoon, on going to bed, and sometimes during the night. In some cases of slow and feeble diges-

tion it is best to give hot milk without other food an hour before each meal and not less than two hours after the meal preceding, or, if milk proves too heavy, hot water must be substituted for a time at least. Fresh meat-juices or one of the good bottled preparations, or raw scraped meat in the form of sandwiches or small meat-cakes, make valuable intermediate meals. It is not a rare thing to overfeed consumptive patients and produce temporary albuminuria. The tongue, urine, and stools of the patient must be noted in those who are undergoing the valuable remedy of forced feeding. Oils and fats, while often desirable as foods, are not always well borne. Cod-liver oil, though a valuable food for some patients, is by no means a specific, but should always be tried in cases where there is waste. The writer has not been impressed with the value of the extracts of cod-liver oil, nor with its inunction.

Intra-laryngeal Injections.

Intra-laryngeal injections have been used with apparent success in the treatment of phthisis and particularly of hæmoptysis. Dr. Colin Campbell reported to the Royal Medico-Chirurgical Society of London [1] favorable results in the treatment of 25 cases. In the subsequent discussion Drs. J. K. Fowler, Mitchell Bruce, K. McLeod, and Routh indorsed this method, while Dr. C. T. Williams condemned it.

Dr. J. L. Barton reports [2] favorable results in 10 cases, and quotes Drs. Horace Green, Bergeron, Pernice, and J. Muir as sanctioning the treatment.

The procedure is to inject with a special syringe 1 to 2 drachms of an antiseptic fluid into the tracheal tube, the nozzle being passed rapidly below the cords and the fluid quickly discharged during inspiration, this being repeated if necessary. The preferable liquid is a 10 per cent. solution of menthol in pure glycerin. For hæmoptysis turpentine is used. The syringe is best fitted with a spring which is released so that the contents are automatically discharged with the least possible friction and effort, and thus the point is not apt to be driven against the walls. The syringe designed by Dr. W. F. Chapell (Tiemann) primarily for submucous injections and modified by the writer fulfils these requirements most satisfactorily. This treatment has had excellent results in lessening expectoration, fœtor, and cough. The objections to the method are, first, the necessity that the operator should have the required skill, and secondly, that the patient should possess a larynx not over-sensitive. The writer has found that the beneficial local effects of antiseptic and stimulating drugs upon the mucous membrane of the trachea and bronchi can be brought about

[1] *British Medical Journal*, 1894, vol. xi. p. 1238.

[2] *New York Medical Record*, August 1, 1896.

more easily and satisfactorily by the use of inhalations after the method described in the following paragraph.

Inhalations.

Most of the inhalers are little more than toys, but if the globe inhaler is used with a large amount of air compressed to not less than 10 lb., and preferably 20 to 30 lb., even so heavy a fluid as compound tincture of benzoin with equal parts of alcohol and glycerin can be vaporized and inhaled in suitable cases with the very best effects. The difficulty in procuring satisfactory inhalations is in getting a sufficient amount of compressed air to maintain the vaporization for fifteen or twenty minutes with force enough to vaporize a gummy solution. The hand-pumps for the purpose of air-compression are all more or less unsatisfactory and hard to work. The best plan is to compress the air with a pump worked by the water-pressure, when there is pressure of 10 lb. or upward in the city water-pipes. A good supply of compressed air is specially needed in using so heavy a fluid as the one named, and the writer's experience has been that the effects are much more marked and lasting when the solution is of such a character. While it is more difficult to volatilize on account of its gummy nature, yet for this very reason it remains longer in contact with the mucous membrane and its effects are more permanent than those of lighter fluids; but when the respiratory tract is especially irritable, or if there is a tendency to hæmorrhage, lighter and less stimulating liquids must be used.

The globe inhaler should have an outlet at the bottom connected with a bottle into which the surplus liquid can drain. This renders the globe much more easy to cleanse. After the use of benzoin it is best to spray out the globe with alcohol to cleanse it and to dissolve the adherent gum, and to wipe the mouth-piece inside and out with cotton soaked in alcohol. The patient should be instructed to inhale through his mouth and exhale through his nostrils, and if he is obliged to cough he should first withdraw his mouth from the inhaler.

It is not believed that any form of inhalation can be safely used to kill the bacilli, nor can inhalations directly open up consolidated areas, but the writer's experience strongly favors the belief that it is an efficient means of relieving cough and expectoration, ventilating cavities, and diminishing the number of streptococci and similar micro-organisms. It is probable that only a small amount of the drugs is absorbed into the tissues, and that the beneficial results are mainly due to their direct effect upon the surface of the respiratory tract, and to the pulmonary exercise of deep inhaling.

In giving inhalations it is very important that the patient should

at first be watched and instructed in regard to the method of breathing, so as to make each inspiration as slow, distinct, and prolonged as possible. By this means the greatest amount of vapor is inhaled and the benefit of deep and full respiratory exercises is received; but it is advisable for the patient to begin with only a few inhalations and cautiously increase their depth. It is, moreover, wise to warn a patient at first to take only two or three inhalations at a time, to rest a few moments and then repeat the same number, taking perhaps twenty inhalations in all. Then, each day he may add three more inhalations until a total of, say, sixty is reached: he must at the same time gradually increase the number of inhalations, resting between the intervals from three to six. The objection made to such a method is that the medication is carried into the healthy and not into the diseased lung; and this is undoubtedly true as regards the diseased air-cells which are occluded, but it is not the case as regards the open tubes or cavities, the vapor being distributed equally through the ramifications of the bronchi in both lungs. Moreover there does not appear to be any injurious effect upon the healthy membrane, through which doubtless a certain amount of absorption takes place. However, it is probable that the chief benefit is derived from the cleansing and stimulating of the bronchial tubes, and from the deep breathing exercises. This treatment should be carried out every day for several weeks until the cough and expectoration become moderate. It requires a little patience and perseverance to overcome the increased cough which is often at first provoked by the inhalations; in such cases it is sometimes advisable to spray the fauces with a weak solution of cocaine before inhaling, until tolerance is established. This treatment is also of benefit in laryngeal and naso-pharyngeal complications. Steam inhalations should only be used in acute and inflammatory conditions, and are positively harmful in chronic tubercular diseases. It is probable that at sea-level inhalations are more efficient when given in connection with treatment in the pneumatic cabinet.

Sprays.

Sprays, except for the direct treatment of the upper air-passages, are useless, because the spray condenses on the walls before it reaches the trachea, and thus the effect is lost beyond the larynx.

Massage, Gymnastics, and Exercise.

The regulation of the exercise is of the utmost importance. Where there is fever or much weakness the exercise should be extremely limited, and sometimes entirely interdicted and massage substituted for it. The writer has seen the greatest benefit derived from massage in suitable cases, and it is to be regretted that the small

attendant inconvenience and expense prevent many patients, whose condition is suitable, from making use of it. In the beginning it should always be used extremely lightly, so that the patient is not unduly fatigued. The majority of masseurs begin too violently, and they are also not always sufficiently careful about protecting their delicate patients from becoming chilled. During the first week or ten days of treatment by massage the fever may be slightly increased and the weight decreased, but later the reverse commonly holds true, and the appetite and general vigor usually improve. The treatment for those who are weak should be given only every other day the first week, after which it may be used with advantage daily for some six weeks; by this time Swedish movements can with safety be substituted for the massage, beginning with the passive and proceeding to the resisting movements. The treatment may be continued for about a month, by which time the patient should be sufficiently strengthened and prepared to use certain moderate gymnastic exercises for himself and begin a more active life out of doors; for instance, he may then be ready for the bicycle, a valuable therapeutic agent in the cure of tuberculosis. The bicycle saddle should permit only of pressure upon the tuberosities of the ischium, and the patient must be warned against fast or long rides as well as against riding in the face of a high wind, or through heavy sand, or up-hill; in fact, the bicycle ought only to be used under the direction of the physician, as heart-strain is not an uncommon result of imprudence.

Horseback riding if begun in the same moderate and cautious way is of still greater value to many consumptives.

Driving in a carriage or riding in electric cars is often beneficial if the patient is sufficiently protected against chill.

Walking, if not too fast or prolonged, is a valuable exercise, as is also the slow climbing of hills. The game of golf, when indulged in without too much excitement, is an admirable method for procuring the advantages of a walk with moderate use of the arms, and moreover it keeps the patient out in the open country a longer time than most people would otherwise find interesting. But in all these games and sports consumptives should especially avoid undue excitement, under the influence of which they are apt to respond to calls for sudden and violent exertion, such as is often required in a match at lawn tennis, which, however, is a good game for convalescents or slightly affected cases, if played with moderation.

One of the difficulties of conducting a case of tuberculosis to a satisfactory conclusion is that when the patient is sufficiently well to take exercise he is apt to think that he does not need his physician's advice, and so, frequently, exercises too much or too little. The same is true in a measure with regard to amusement, which in some form

is generally a necessary element of successful treatment, but which the physician is seldom allowed to control.

It is of the utmost importance to the patient that his daily life in all its aspects should be directed by a physician, and it is the practicability of such supervision that gives to sanitarium treatment its special value.

Bathing.

The cleanliness and activity of the skin are of great importance in cases of pulmonary tuberculosis, and the judicious use of hot and cold water is also of great service in stimulating the healthy functions of the nervous and circulatory systems; it is probable that it is mainly for the same reasons that cold bathing does good in cases of typhoid. As a rule the bathing should be in either hot or cold water rather than in warm. Where the accommodations admit of taking a hot tub-bath and the free use of soap, followed first by cold douching with a sponge while the patient is still standing in the hot water, and then brisk rubbing, the writer has obtained the very best results in producing a beneficial and pleasant shock and in preventing cold-catching. Where the patient is delicate these baths should not be taken oftener then every other day. Shower, needle, and massage baths are also beneficial in certain cases. An alcohol rub after the bath sometimes adds to its efficacy.

Clothing.

I have little to add to what Dr. Cohen has previously said, except to reiterate the importance of wearing wool or silk next to the skin, both day and night, a change being made between the day- and night-clothing, and that the clothing of the patient, and especially his foot-wear, should claim the attention of his physician.

Sanitarium Treatment.

Unfortunately, much prejudice exists against the use of sanitariums by consumptives. There is no class of invalids which stands in greater need of them, nor any patients in whom better results are obtained from their proper use. The reasons for the prejudice felt against sanitariums are many, among them the dread of infection from other cases, which is a groundless fear if the sanitarium is what it should be; good sanitaria are far better ventilated and cleaner than most lodging-places, and statistics of the excellent health of their staffs corroborate this statement.

Sanitariums are, moreover, not generally in good repute, because the regular profession have paid too little attention to the supervision of the rest, exercise, food, lodging, clothing, etc., of their patients, and have been in the habit of leaving these details largely in the

hands of mercenary, unscrupulous, or ignorant persons, while they themselves have only considered the diagnosis and prognosis of the case and its treatment by drugs. Sanitariums should have not only a competent superintendent, but also a visiting staff as has a hospital.

Another difficulty to be overcome in inducing consumptives to enter sanitariums is the old idea which still lingers in the minds of many laymen and doctors that tuberculosis is always and absolutely a hopeless disease. On this account many patients object to being marked as consumptives, herded together and isolated in an establishment with those about to die. One of the drawbacks of bringing patients together is their common tendency to talk about and dwell upon their physical condition. This, however, can be largely overcome by a wise superintendent. The benefits derived from sanitarium life are thus both direct and indirect, and patients who have been in good sanitariums are usually much more intelligent in taking care of themselves after they come out.

Well-equipped sanitariums should possess means for giving massage, gymnastics, etc., as well as for different forms of bathing, rooms for entertainments and porches having varied aspects with wind and sun shelters where needed. Adjacent cottages are best for use in fairly robust cases and for families, but the heating, ventilating, and plumbing are more expensive and not so easily managed, and therefore cottages are not so well adapted for those who are seriously affected. The grounds should have walks and shelters, golf links, croquet and bowling lawns. Gardening is a pursuit of great service to convalescents. The argument in favor of sanitariums is admirably put by Dr. E. O. Otis in an article on "The Sanitarium or Close Treatment of Phthisis."[1]

In Germany the Red Cross hospitals built during the Franco-Prussian War are now being utilized as sanitariums for the poor. The practical economy of placing wage-earners, and those who carry life-insurance, in sanitariums as soon as possible after tuberculosis has developed is shown by the experience of the Hanseatic Association (an insurance society for sickness and old age). The managers report that of 226 tubercular persons sent by them to a sanitarium 155 were able to resume their occupations, and they said that if only 29.2 per cent. are able to go back and work for even one year the amount of payments thus saved covers all expense.[2]

The writer's article on Climate in Vol. I. of this SYSTEM contains some statistics and arguments in favor of sanitariums, as also does his

[1] *N. Y. Medical Journal*, June 13, 1896.

[2] This and other instances of the same economy are given in an article in the *Deutsche med. Wochenschrift*, Sept. 3, 1896, quoted by the *Journal of the American Medical Association*, Nov. 7, 1896, p. 1026.

Handbook of Medical Climatology; and further, his practical experience with sanitariums in Colorado Springs is entirely favorable to sanitarium treatment.

Fresh Air.

Out-door air is of the greatest necessity to tuberculous persons, and no cure can be established unless the patient leads an out-door life. This is true even when the air breathed is not of the best, as in crowded cities or in bad climates, but some patients whose condition is weak, who have a susceptibility to cold, or who lack a place to rest in out of doors, have to make in-doors as much out of doors as possible; that is, they must have their windows and shutters open and lie or sit during the day in the sun and air near the windows, even if it be necessary to wear their caps and overcoats. At night they should still keep their windows open, but if the air is too cold or if there is much wind a thin canvas screen should be inserted below the sash. If the air is damp the room ought to be artificially heated, preferably by an open fire. The temperature of the air in the room should be low while the patient is in bed, but warm, 65° to 70° F., while he is bathing and dressing. The principle is to breathe cold air, but to protect the surface of the body against a chill. The air of a room which is heated either artificially or by the sun and properly ventilated is always drier than is the air outside, especially in moist climates. Those invalids to whom, on account of their catarrhal tendencies, damp cold air is obnoxious had best stay in-doors on chilly damp days, especially if they are not strong enough to keep warm by exercising. The practice of keeping windows open and living much out of doors, however, soon hardens the majority of invalids, so that there is little danger of catching cold. Next in value to the openness of the air is its purity, upon which subject the following quotation from the writer's work on Climatology is pertinent:

"The experiments of Brown-Séquard, Stokes, Trudeau, and others show that when animals which have been successfully inoculated with bacillary matter are kept in confined spaces with imperfect ventilation they become tuberculous, while those which, after similar inoculations, are kept in open-air quarters escape the disease. This goes to prove that the presence of pure air not only makes infection from the bacilli less likely, but that even when they are received through inoculation or otherwise it aids the body's natural resistance and promotes recovery. Therefore, the first essential of a climate for a consumptive is pure air, because it assists to a cure and lessens the dangers from infection." [1]

Thus the first thing is to give the tuberculous person as much and as pure air as his environment permits.

[1] *Handbook of Medical Climatology*, by S. E. Solly, M. D. Lea Brothers & Co.

Climate.

Humidity and Temperature.—With respect to the relative value of air in regard to its humidity and temperature I will further quote:

"It is found that, other conditions being equal, consumption is most prevalent in climates in proportion to the temperature and humidity as follows: First come damp cold climates; second, damp hot climates; third, dry hot climates; and fourth, dry cold climates; and, in promoting recovery from consumption, as a broad statement the reverse order holds good. Thus, in a general way, it may be said that dampness is harmful to the consumptive and dryness beneficial, while the relative effects of heat and cold depend upon the humidity. Therefore, in a damp climate, heat, except when tropical, is less harmful than cold; while in a dry climate cold, on the contrary, is more beneficial than heat—that is, to the vital resistance, though not always to the disease.

"Apparently, humidity of the air, apart from other factors, does not in itself produce phthisis. The comparative immunity from consumption among the men of the British navy contrasted with those of the army, and the rarity of the disease in many islands, such as the Faroe, the Shetlands, the Hebrides, and Iceland, show this. The influence of these climates and of sea-voyages on the disease when developed and active has, however, not been shown by the evidence of others nor by my own observation to be advantageous, removal from the sea being generally of most benefit. Where advantage has been derived from a sea climate it would appear probable that it was owing to the great purity of the air or the elimination of unsanitary conditions and hurtful occupations.

"Dryness of the air, on the contrary, is known to be of positive benefit to the consumptive. The excellent results obtained from desert air (apart from great altitudes, which we will consider later) are too well known to quote at length.

"In crediting dryness of air *per se* with a beneficial influence upon phthisis, we must not forget that some share of the credit, at least, belongs to the other necessary accompanying factors of a dry atmosphere, namely, more powerful sunlight and heat, less depressing cloudy weather, cooler nights and shade, and a higher electric tension of the body. What is also of prime importance is the greater opportunity for exercising and resting in the open air, and the free access of fresh air to the house by day and by night while the patient is in-doors."[1]

Range of Temperature.—The evidence collected by Hirsch and others shows that "Severe and sudden changes of temperature

[1] *Handbook of Medical Climatology,* by S. E. Solly, M. D. Lea Brothers & Co

have no more determining influence *per se* than has the absolute height of the temperature." It is further shown, however, that variability if accompanied by dryness is usually beneficial, but variability with dampness is positively harmful.

Wind.—"Consumption is neither more nor less prevalent in a place simply because it is windy, nor are consumptives as a class made better or worse by this element alone. It is beneficial or detrimental according to its temperature and humidity and the patient's condition; that is, according to his need of stimulation or sedation.

"*Cold moist wind* sometimes soothes, but more often depresses the patient, while it aggravates catarrhal affections if they be of a relaxed type.

"*Cold dry wind* simply stimulates or else irritates the patient, and hence it improves relaxed catarrhal conditions, but makes those which are inflammatory worse.

"*Warm moist wind* lessens irritability, and is either soothing or depressing.

"*Warm dry wind* acts as a tonic or increases irritability."[1]

Sunlight is of the greatest benefit in promoting healthy growth, increasing the oxidation of tissue, and pleasantly stimulating the nervous system of the consumptive. Sun heat, if not excessive, has an agreeable sedative influence, is the cheapest and best of germicides, and is especially valuable in inducing delicate invalids to spend more time out of doors than they otherwise would.

Barometric pressure, if markedly decreased as at high altitudes, has been shown to have a powerful influence over anæmia through increasing the amount and quality of the red blood-corpuscles and hæmoglobin, as demonstrated by numerous experiments, notably those of Regnard. It is probable that this hæmatogenetic effect is the chief cause of the marked benefit usually derived from a change to a high altitude by the victims of tuberculosis.

Results of the Climatic Treatment of Phthisis.

In endeavoring to ascertain the definite effects of change of climate upon the progress of phthisis the writer collected all the reports of results of change of climate upon consumptives which he could find at the time of writing his book upon Climatology, and the detailed reports will be found in it. The number of cases reported was over 8000; of these, 7795 admitted of tabulation for the purpose of comparison. It must, of course, be admitted that the material of which the cases are composed is too variable in quality to allow of any close comparison of results, but as the number of cases and of reporters is

[1] *Handbook of Medical Climatology*, by S. E. Solly, M. D. Lea Brothers & Co.

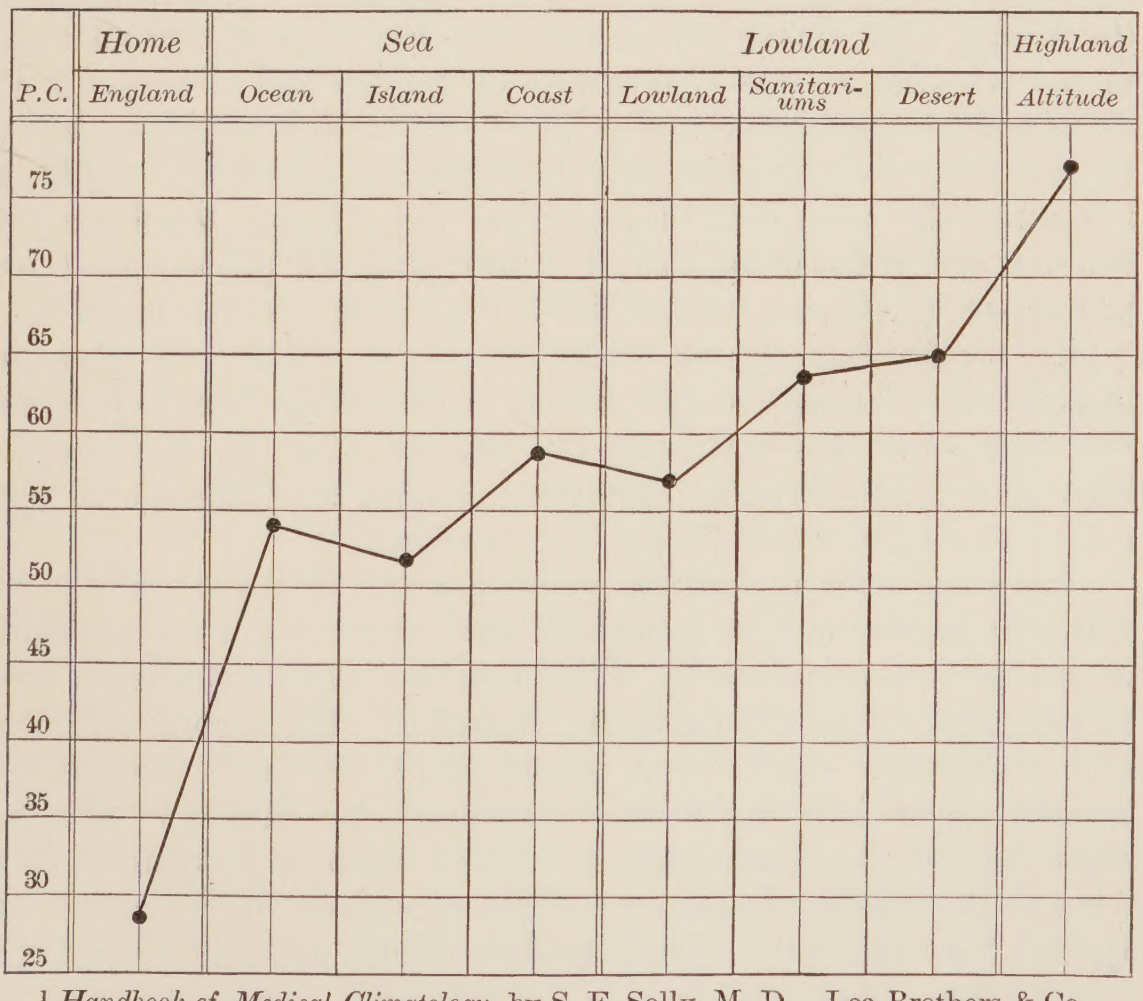
so great the law of averages comes in to help us. "In the use of this law the very widespread diversity of opinions, ability, opportunity, material, and season comes as an aid instead of a hindrance, and enables us to find, in place of nice comparisons, governing principles, and so we gain some insight into the why, wherefore, and whither of these varied and sometimes incongruous statements. It is necessary, therefore, to arrange these reports in groups, in which are given a sufficient number of reports and reporters to equalize the variations and to afford a fair average; thus comparisons can be made which, it is reasonable to believe, indicate in a general way the relative values of the several varieties of climate in the treatment of phthisis.

"The conclusions drawn from the statistics are confirmed or modified by what we may regard as reasonable deductions from our knowledge of the physiological and other influences of climate, and by other statistics which show the geographical distribution of the disease." [1]

"If we extract the percentages of results for all stages of each group and put them in order, progressing from the ocean up to the high altitudes, we see an almost steady rise in the percentage of improvement as we proceed toward the highlands, as illustrated by the chart.

FIG. 1.

Analysis of 7795 Cases of Phthisis.



[1] *Handbook of Medical Climatology*, by S. E. Solly, M. D. Lea Brothers & Co..

"It will be observed that the rise would be uniform were it not that the results from ocean voyages run 2 per cent. higher than those from the sea islands, and that the results from the low inland resorts drop back 2 per cent. below the seacoast climates. As has been before remarked, the selection of the cases sent on sea-voyages is usually more carefully made, and their living more out of doors in a purer air than they would do on shore may account for this slightly better result.

"The total percentage of the low inland results is lowered by those of Rome and Pau, otherwise they probably would not have shown the slight dropping back of 2 per cent. below the Riviera reports. It is very much to be regretted that the physicians of Southern California give no reports, and also that none can be had from Thomasville nor from many other good inland places. The few cases reported from Southern California were not on the coast, or they would have been classed with the Riviera group."

On looking at this chart it will be seen that the two climatic factors which have apparently the greatest effect upon the results are sea and mountain air. The results of treatment in England are inserted under the title of "home climates," as the change of climate for these cases was so slight that the results may be said to illustrate the effect of leaving the patient in the climate in which he acquired the disease. The improvement shown in cases of phthisis of all stages in the sea climates was 57 per cent., in the lowland climates 63 per cent., and in the high climates 76 per cent. This indicates that as the sea influence diminishes the improvement increases. Again, as indicating the superiority of high over low climates, if all the low climates are grouped together it is seen that the percentage of improvement was 59 per cent., while in high climates it is 76 per cent. "This inquiry has clearly demonstrated two things, viz. that the majority of consumptives do better, other things being equal, the farther they are removed from the sea, and that they do better in high than in low altitudes, wherever situated, the difference in proportionate improvement being here exhibited."[1]

It will be noticed that the results reported from the sanitaria are markedly higher than the average of improvement in the open resorts in similar lowland climates. This confirms what has already been said about the value of sanitarium treatment. The reports separated into the different stages—first, second, and third—were too deficient to form the basis of any broad comparisons, yet they show that the reports of the first-stage cases are much better in proportion than those of the combined stages or of the second or third stages; this appears to confirm the common opinion that the majority of incipient

[1] *Handbook of Medical Climatology*, by S. E. Solly, M. D. Lea Brothers & Co.

cases are benefited more or less by any climatic change, as in fact they generally are by *any* change of treatment. The important question as to the relative permanency of the benefit derived in the various climates could not be extracted from the information obtained. The very ease with which early cases are improved by mere climatic change is in itself a source of danger, because as a consequence these patients too often return prematurely to their former environment, thinking themselves cured.

These statistical inquiries undoubtedly show very clearly the general tendency of the influence of climate upon phthisis, and it will be found that most forms of tuberculosis follow the same lines as those of phthisis. There are, of course, certain exceptions where altitude is objectionable and sea air beneficial. It is not possible within the limits of this article to discuss the various forms of phthisis as influenced by climate, but it may be said in a broad general sense that the purely tuberculous cases do best in cool dry climates, and next best in warm dry ones, while inflammatory cases of an erethic type may do best in a warm moist climate and next best in a warm dry one, and catarrhal cases of febrile or irritable character do best in a warm dry atmosphere, but in catarrhal cases which are not inclined to fever or nervous irritability the reverse holds true.

With regard to the elevation, high altitudes are of benefit to the great majority of cases of phthisis, particularly those of a tuberculous type, and in all cases in which anæmia is marked. The chief contra-indications are diseases of the heart, a limited area of healthy lung, advanced fibrosis, marked erethic tendencies, and old age.

Cases Suitable for Climatic Change.

In order to lay down a rational and systematic plan of treatment the tuberculous individual and his circumstances must be duly considered as well as the type and stage of his disease. This is especially true when the matter of change of climate is under consideration. There are many patients to whom, on account of their circumstances, leaving home is a real hardship, and these should not be forced to do so unless home treatment is not succeeding. Of such cases those in which the disease has arisen under peculiarly unfavorable conditions of life may often be safely allowed to remain for a time, at least until the tendencies of the case are clearly indicated, if such conditions can be removed and the environment made hygienic. Some of those in whom the tuberculosis is not advanced or active and whose ill health appears to be due not so much to this as to indigestion or other causes which can be treated at home, may remain if they are carefully watched. Occasionally a change of house, soil, or conditions physical or social, will put the patient on the road to recovery if the

accompanying treatment is judicious. Hereditary cases should always be sent away, and as a rule the change must be permanent. Cases resulting from pneumonia, pleurisy, or bronchial catarrh, which are slow in clearing up should have climatic change, and, where the patient can afford it and domestic ties do not interfere, it is always safer to advise an appropriate change. In doing this the habits and requirements of the patient must be considered, as well as the climate of the resort to which he is to be sent. Before selecting a climate the physician should acquaint himself with the principles of medical climatology as well as with the details of the resorts.

THE PRESENT TREATMENT OF SYPHILIS.

By EDWARD MARTIN, M. D.

When and How should Syphilis be Treated Constitutionally?

In recent years those best versed in syphilology have differed in regard to the best time for beginning the constitutional treatment of syphilis. Doubtless, the weight of authority is in favor of withholding specific treatment until general adenopathy or secondary eruptions on the skin or mucous membrane appear. The reason for thus withholding treatment is either that the diagnosis of syphilis can be established beyond doubt only by adenopathy or the syphilides, or that the disease does not reach that stage in its evolution which is most favorably influenced by the exhibition of specific medicament till symptoms of the secondary period have developed.

It is clear that those who do not believe in giving mercury till the diagnosis of syphilis is absolutely established will, save in exceptional cases, be compelled to wait for the secondary eruption, since it is now universally conceded that the most typical local sore may not be syphilitic in nature, or at least may never be followed by other manifestations of the disease.

In direct opposition to the practice of waiting for a certain diagnosis, there are many who urge that treatment should be inaugurated the moment a probable diagnosis is established. The theoretical reasons for this plan of action seem to me conclusive, and, in so far as practical results are concerned, I believe them to prove that the disease is most certainly, easily, and permanently cured by an active, intelligently directed treatment, begun early and long continued.

It is generally conceded that syphilis is a microbian disease; that it enters the system at one point, multiplies there, and finally involves the entire organism; that its effects are counteracted and its virus weakened and ultimately destroyed by mercury.

These facts being true, it seems difficult to understand what reason there should be for delay in the exhibition of the specific drug after diagnosis is once fully confirmed; hence the treatment should be instituted as soon as a chancre is observed.

The main difficulty lies in deciding whether or not a given sore is

a chancre. I have already said that a positive diagnosis of chancre cannot be made; if, however, a genital sore is single, is of more than fifteen days' incubation, becomes indurated in the course of a week, and produces a typical non-inflammatory polyglandular inguinal enlargement, in at least nine cases out of ten such a sore is a chancre. In a few cases, even under such circumstances, secondaries fail to develop either at the regular time or at a subsequent period, and we have been in the habit of regarding such sores as non-specific. This is not necessarily true. Syphilis inoculated upon a resistant system may produce a chancre and no other lesions. It is, however, undoubtedly true that some few sores may correspond absolutely to the type of chancre, although they are not syphilitic.

The strongest argument against early treatment of syphilis is, then, based on the ground of this uncertainty of diagnosis, since it is held that by beginning treatment at an early stage the development of the secondaries is prevented, or at least always retarded, and that neither the surgeon nor the patient can ever be quite sure that syphilis is really present. It is also maintained that as a result of this early treatment the secondaries are irregular and unusually severe.

It is quite true that the administration of mercury during the primary period will almost certainly delay the secondaries, and will make them atypical, at least in regard to their time of eruption. It is, however, by no means proven that lesions when they do occur are more than ordinarily severe. This assertion is made on entirely insufficient evidence, and, as far as my own experience is concerned, is utterly unfounded. It is only fair to state that this point must be settled by clinical study of a large number of cases extending through both the secondary and tertiary periods of syphilis. Such an adequate study has not yet been recorded.

If the practitioner, following the teaching of many of our most eminent and experienced syphilologists, decides to withhold specific treatment until the diagnosis of syphilis is absolutely corroborated by the appearance of secondary lesions, he will do well not to wait for general adenopathy or the eruption upon the skin or mucous membrane, since these are not the first unmistakable signs of constitutional involvement; but, rather, he will institute from the time syphilis is suspected a series of examinations of the blood. If, without otherwise obvious cause, there is a pronounced decrease in hæmoglobin and a moderate increase in the number of the white corpuscles, this, together with the chancre, is sufficiently indicative of syphilis to justify positive diagnosis, and, since it precedes by one or two weeks the development of other secondaries, enables the practitioner to institute a specific treatment this much earlier. It is worthy of note that this anæmia does not invariably develop; hence when the blood remains

normal it will be necessary to wait for adenopathy, exanthemata, or other characteristic early manifestations of the disease.

I would urge, however, that the constitutional treatment of syphilis be begun the moment a probable diagnosis is formulated. As a result of this practice it is possible that two or three patients in the hundred may receive a prolonged mercurial course although their sores are not specific. In the remainder the disease will be combated practically from its incipiency, and lesions of the secondary or tertiary stage will not develop. This early treatment is a valuable means of confirming the diagnosis, since the rapid disappearance of induration, the healing of ulceration, and the lessening of inguinal enlargement under an active mercurial course are not likely to occur except the sore be syphilitic.

Excision of the Chancre.—The treatment of the chancre is a matter of considerable importance if the doctrine of a specific germ as the cause of syphilis is accepted. The local sore represents the seat of entrance of the germ. At this place it multiplies, and from it is distributed through the system. Prompt excision, destruction, or disinfection of this infecting focus seems as reasonable as would a similar procedure in the case of an ordinary poisoned wound. Experience has shown that excision, even if performed at the earliest period, does not necessarily prevent the development of constitutional syphilis, possibly never accomplishes this end, though there are many recorded cases which apparently prove that the disease in a small percentage of cases is prevented. Even though the procedure does not succeed in preventing the development of syphilis, it is reasonable to believe that by removing the original focus of infection the dose of the virus is lessened, and thus the effect upon the system is rendered less severe.

As for the practical application of the general principle of excision or destruction of a chancre, when the patient presents himself with a sore which has developed more than fifteen days after exposure, and which is chancrous in its mode of onset, if seen early, or in its development if seen after some days, the infiltrated and ulcerated tissue should be immediately removed or destroyed.

This treatment is even more imperatively indicated if by confrontation the diagnosis of syphilis can be more positively established. If the sore is on the prepuce, particularly about the preputial orifice, circumcision should be advised, since thus there is a removal of tissue wide of the infiltrated area. When the glans is affected excision followed by cauterization is indicated. If such excision and cauterization would imply mutilation of the glans so great as seriously to interfere with function, the operation should of course not be performed. When the lesion is on the inner layer of the prepuce close

to the coronary sulcus, it may be picked up with a pair of rat-tooth forceps and cut away with scissors.

Schleich's method of infiltration anæsthesia will render all these procedures absolutely painless, obviating the necessity for using ether.

If, because of objection on the part of the patient or for reasons sufficient to the surgeon, excision or destruction of the sore is not attempted, it should be cleansed and dressed in accordance with general surgical principles.

Constitutional Treatment of Syphilis.

At whatever period the treatment of syphilis is begun, the medicine first given is mercury in some one of its forms. This drug, properly administered, is a specific, and we can reasonably expect to definitely and permanently cure nine patients out of ten who conscientiously pursue for four years the course of treatment laid down for them. The patient must, however, not conceive the idea that his cure depends only upon the regular ingestion of the medicine which he is ordered to take. His general health must be brought to its highest degree of perfection, and thus maintained until the poison with which his system is infected is entirely eliminated or destroyed.

Before beginning the mercurial a general physical examination is made; the condition of the kidneys is determined by a number of analyses of the urine; the teeth are put in the best possible condition; the diet is regulated; the general life of the patient is so directed that it may be as hygienic as his surroundings admit; and he is instructed to pay particular attention to the cleanliness of his mouth, using a toothpick and brush after each meal, at night, and in the morning, and employing a mild antiseptic and astringent mouth-wash, such as diluted tincture of myrrh. It is well to have regular examinations of the blood made, since in this way timely warning as to the inadequacy of treatment may be given.

Instructions in regard to general hygiene and medication appropriate to the condition of the patient having been ordered, the questions as to the dosage of mercury and the form in which it shall be given are next to be considered. Patients with foul, decaying teeth are easily salivated. The toxic effects of mercury are still more readily manifested on those with chronic kidney disease. Under such circumstances the drug must be given with extreme caution and must be carefully watched. Occasionally a patient is encountered in whom even a small dose of mercury acts as a virulent poison. This is a matter of idiosyncrasy. With the exceptions just mentioned the drug can be administered safely in the doses hereafter named.

Mercury may be administered by inunction, by the mouth, or by

hypodermic injection. Baths, plasters, and vaporization are also employed as means of causing the absorption of the drug, but are so little used at the present day that I shall not consider them in this article.

Of the three popular methods just mentioned, the safest, most efficient, and least hurtful is that by inunction. The most convenient method—one which is in the majority of cases efficient—is by mouth administration. The method most prompt in its immediate effect, but most painful, most dangerous, and least applicable in private practice is by hypodermic injection.

All these methods have their proper indication, and one should not be used entirely to the exclusion of others. Whenever it is possible, however, I believe that the treatment throughout should be conducted by inunction. When for obvious reasons this method is inapplicable, the mercury should be taken by the mouth. In certain exceptional cases hypodermic injections will prove of the greatest service.

Inunctions.—I have been in the habit of using for inunctions the freshly prepared unguentum hydrargyri or blue ointment of the U. S. Pharmacopœia, undiluted. This is put up in half-drachm or drachm doses, either wrapped in wax-paper or enclosed in cachets. It is well to have the patient bring for inspection the first prescription which he has filled, since rancid ointment is often sold, or it is so stiff and hard as to be of little service. When he is thus familiarized with the proper preparation he is not likely subsequently to be deceived.

Taylor recommends the following preparation :

℞.	Mercury,	ʒviij (240.0);
	Lanolin,	ʒxxj (84.0);
	Lard,	ʒxlv (180.0);
	Compound tincture of benzoin,	♏clx (10.0);
	Alcohol,	♏lxxx (5.65).

Triturate the mercury with the tincture and alcohol until coarsely subdivided. Then add portions of the lanolin and lard, and continue the trituration until the mercury is thoroughly subdivided. This ointment is put up in soft gelatin capsules called ovules, which contain either 30 or 60 grains.

Although the term inunction is used in describing this method of treatment, recent research seems to show that absorption is dependent rather upon prolonged contact of the ointment with the skin than upon vigorous friction. It is, moreover, apparent that this prolonged contact is less likely to produce dermatitis than is friction. Hence it is not necessary to instruct the patient to employ vigorous or prolonged rubbing, but rather to direct him to spread the ointment evenly over

a given surface, taking ten to fifteen minutes for this purpose; then to apply over this a woollen garment which should be changed not oftener than once a week.

When the patient is strong, well-nourished, has healthy kidneys and clean teeth, and has exhibited no idiosyncrasy to the drug, treatment may be started by ordering him a drachm of mercurial ointment a day. Anæmic, ill-nourished patients or those with visceral diseases are best treated by much smaller doses at the beginning.

The patient is directed to rub the first drachm of mercury into the left side of the body, using no pressure and simply carrying the hand over the surface of the ribs and the side of the abdomen until the ointment is evenly spread over this surface; this is best done before retiring at night. A flannel undershirt is then put on, over which can be drawn the ordinary night-clothes. The next morning the patient takes a sweat-bath, followed by a cool shower- or sponge-bath, and puts on clean underclothing, the undershirt worn the night before being laid aside for further use. The second night the second drachm is rubbed in on the other side of the body: the same undershirt is again put on. The third night the front of the chest and belly receive the ointment; the fourth night the small of the back, indeed all of the lower dorsal region that can be reached by the two hands; the fifth night, the whole surface of the left arm and shoulder; the sixth night, the corresponding portion of the right arm and shoulder; the seventh night, the left side again. The undershirt which has been worn for seven nights may then be destroyed or washed. In workingmen who are accustomed to wear the same underclothing for a week at a time the morning bath may be omitted, the undershirt being worn night and day.

During this course of treatment the patient should be seen at least every other day by the physician, and should be so instructed that he will recognize the prodromal symptoms of salivation. He should be weighed at least once a week and a record kept of his weight. It must be remembered that under the rubbing treatment salivation may be sudden and severe.

In the absence of symptoms or when under treatment they rapidly disappear inunctions should be given in series of twelve, an interval of six days being allowed to elapse between each series. When symptoms are present and do not yield, or if they develop during the course of inunctions, the quantity of mercury administered must be increased, and the inunctions must be continued without intermission until the symptoms disappear, unless salivation threatens. This may require twenty-four or thirty-six consecutive rubbings of 2 or even 3 drachms of mercury at each dose. When these large doses of the drug are administered the

patient must be kept closely under observation, and the physician must be on the watch not only for the ordinary symptoms of salivation, but for such signs of mercurial intoxication as loss of weight, deterioration in the condition of the blood, loss of appetite, diarrhœa, colicky stools, and albuminuria.

The length of time during which the inunction should be continued, with six days' rest after each series of twelve, is eighteen months. During this period there will have been six months' rest and twelve months of rubbing. The dosage must be most carefully regulated lest by over-zealous treatment the patient suffer more harm than he would from his unchecked disease; this may require the use of much smaller doses than those given. After eighteen months rubbing should be continued in series of twelves with an interval of twelve days' rest between each series, provided there has been no outbreak of symptoms. Under such circumstances a more active course of treatment should be instituted. After three years it is well to continue still a fourth year with a series of twelve rubbings, giving twenty-four days' rest between each series. In the third year moderate doses of iodide of potassium may be serviceable, even in the absence of symptoms. When tertiary symptoms manifest themselves iodides should, as a rule, be given, but not to the exclusion of mercury.

Exceptional cases will be encountered in which small doses of any of the iodides either disorder the stomach, produce acneiform eruptions upon the skin or rapidly diminish the body-weight. Under these circumstances it is best to omit the drug, unless a lesion is developing which by its effect upon a vital or an essentially important organ threatens to shorten the life of the patient or permanently cripple him.

After the fourth year all inunction treatment may be omitted unless subsequently specific symptoms develop. Under such circumstances treatment should be again instituted, and should be continued for at least six months.

Mouth Administration.—The administration of mercury by the mouth is the simplest method of giving the drug, and is the one commonly applicable, since the great majority of patients will not submit to the loss of time, the trouble, and the uncleanliness necessitated by inunction treatment. The physician has little difficulty in inducing his patients to take regularly, for months or years at a time, a medicine which can be carried in the waistcoat-pocket, and which can be ingested without attracting attention to the fact that a course of treatment is being taken.

The administration of mercury by the mouth is open to the objections that it is likely to produce a certain amount of gastro-enteritis,

and that the amount of absorption of the drug depends to a great extent upon the condition of the stomach and intestines, and hence must vary greatly even when the same dose is administered. In spite of these objections, the vast majority of syphilitic patients are treated by internal medication, and the results of this treatment are extremely good.

Of all the various preparations which may be given, I believe the preference should be given to mass. hydrarg., hydrarg. protiodide, and hydrarg. cum cret.

Since there is nearly always associated with syphilis, at least in its early stages, a more or less pronounced anæmia, iron is advantageously incorporated with the mercury. I have been in the habit of ordering the following prescription:

℞. Ferri carb., gr. ij (0.1);
Mass. hydrarg., gr. ij (0.1).—M.
Ft. pil. No. j.
Sig. Three to six such pills after meals, daily.

It is evident that patients vary greatly in their susceptibility to mercury, in their tolerance of this drug, and that varying quantities of the medicament will be required to subdue the symptoms of constitutional disease even in the same person. With the idea of determining individual susceptibility, and from this as a basis establishing an individual dose of mercury for each patient, Keyes formulated a plan by which he first produces by gradually increasing doses of the drug the prodromal symptoms of salivation. The mercury is then withdrawn till these symptoms entirely disappear, after which the patient is directed to continue throughout the entire course of treatment half the daily dose required to produce such symptoms. When secondary outbreaks occur the dose is increased until all manifestations of the disease disappear.

Absolute reliance cannot be placed on this method of gauging the dose, since individual susceptibility is subject to change, or it may be that absorption of mercury when taken by the mouth is so dependent upon the condition of the gastro-intestinal canal, and consequently varies so greatly at different times, that it is difficult to determine what portion of a dose taken into the stomach is absorbed into the system and is active in combating the disease. Keyes' plan of procedure is, however, an excellent one, and is to be commended as a routine practice.

In determining the quantity of mercury necessary to produce slight toxic effects the symptom of beginning salivation should be taken, rather than of intestinal colic and watery stools. The latter

often denote simply that gastro-enteritis has developed as the result of a local irritating effect of the drug. The urine should always be regularly examined at the beginning of the mercurial course, since the first symptoms of hydrargyrism are sometimes manifested in the forms of albuminuria and cylindruria.

Protiodide of mercury is one of the most popular preparations for mouth administration. Belief in its efficiency is perhaps based in part upon the hope that the chemical combination of mercury with iodine may produce the effect of each of these drugs when given separately. In many cases protiodide will be found more serviceable than any other form of mercury. At times it produces loss of appetite, griping pains, and watery stools long before sufficient mercury has been absorbed to favorably influence the course of the specific disease. Under these circumstances opium in small doses may be combined with it. This, I think, is undesirable, since the opium, though it may control the symptoms of stomach and bowel irritation, is not likely to lessen the catarrhal inflammation, the persistence of which materially interferes with proper absorption of mercury.

The yellow mercurous iodide (protiodide) may be given in pill or tablet form each to contain gr. $\frac{1}{6}$. The initial dose should be three pills daily, taken after meals. Every second day the dose is increased by one pill, till the earliest symptoms of salivation are produced. If, for instance, this occurs when twelve pills have been taken, after a period of rest devoted to curing the slight salivation, the pills are continued six a day, with intervals of rest, for four years, decreasing the dose and increasing the intervals of rest in the last two years.

Gray powder (hydrargyrum cum creta) may be found serviceable when protiodide disagrees, since it is not inclined to purge. It contains 38 per cent. of mercury, and should be given in 5-grain doses three to six times a day.

Bichloride may be administered in doses of $\frac{1}{12}$ of a grain well diluted. Because of the uncertainty of absorption when mercury is given by the stomach, and possibly because long continuance of the drug is likely to produce a condition of chronic gastro-enteritis, even though it be decided to treat syphilis by the internal medication, it is well to supplement this, or rather to substitute it at regular intervals, by the more certain method of giving the drug by inunction. This substitution is particularly important if the disease is not running a favorable course—*i. e.* if there are frequent and severe relapses or the patient's general condition is rapidly deteriorating. A course of fourteen inunctions may be given every six weeks; after two years, every twelve weeks; after three years, every twenty-two weeks. If it is impossible to employ inunction in this way, hypodermic injections

are serviceable. These also should be given in series and at intervals such as are appropriate for inunctions.

When, because of the amount of stomach irritation, one salt of mercury must be suspended, another may be substituted, remembering that one of the secrets of success in the use of the drug is to give it well diluted.

If after several attempts at substitution it is evident that mercury in any form by mouth administration is likely to keep up a chronic stomach indigestion and irritation of the bowels, the drug should be administered by inunction or by hypodermic injection.

Hypodermic Injection.—This method of administering mercury, so enthusiastically praised by certain leading syphilographers and heralded as the coming treatment of syphilis, seems now to have fairly found its place. It is not likely to supplant either inunction or mouth-treatment. It is, however, extremely serviceable in certain cases, and will probably be employed at times by nearly all syphilologists. Reference has already been made to the disadvantages of the method. It is often, not always, painful; it is impossible to predict when it will be painful or how long the pain will last: twenty injections may be given without occasioning any pain; the twenty-first given in precisely the same way may cripple the patient for days. It is more likely to produce severe toxic effects than when mercury is administered in any other form.

In careful hands abscess formation almost certainly can be avoided; therefore this need not be considered an objection to the employment of this method of treatment.

Two general classes of preparations are employed—the soluble and the insoluble. The soluble preparations are absorbed quickly, but their effect is transitory. The insoluble preparations lie in the tissues for months, acting as reservoirs from which is drawn a constant dosage of mercury. Their action is then slow, but prolonged.

Toxic effects much more frequently follow the use of the insoluble than of the soluble preparations. This can also be said of severe pain and suppurative inflammations.

As a rule, the soluble preparations are to be preferred for the reasons just given—*i. e.* promptness of action, painlessness, and comparative innocuousness. Probably the best preparation is that of bichloride. The syringe employed should be clean; it is well to wash it out thoroughly with boiling hot water several times, after this using a mild solution of formalin or absolute alcohol. The needle should be sterilized by boiling in a test-tube immediately before its use. The skin should be scrubbed well with absolute alcohol, and the needle should be driven in vertically by a sudden thrust until its point enters the muscular tissue, since the injection, if thus made, is less likely

to give pain and cause suppuration, and is more quickly absorbed. It is true that suppuration beneath the deep fascia is much more dangerous and difficult to treat than that superficially placed; if the injection is properly practised, however, there is little danger of this accident. The beginning dose should not be greater than $\frac{1}{10}$ grain, unless it has been previously established that the patient is not especially sensitive to mercury. This dose can be steadily increased until $\frac{1}{3}$ grain three to six times a week is reached. In some cases I have given double or even triple this dose with benefit to the patient.

The injection may be driven into the dorsal region or into the buttocks. If the dorsal region be selected, the needle should be entered half an inch to the right or left of the first six spinous processes. This enables the mercury to be forced into the muscular tissues at points where they are not richly supplied by sensory nerves. The first injection should be placed to the right of the first dorsal spinous process; the second to the left; the third to the right of the second spinous process, and the injection should be so continued downward. In keeping a record of the case the seat of each injection can be readily marked down on a rough diagram. This is particularly important when insoluble preparations of mercury are used, since thus in case of serious mercuric intoxication the surgeon is enabled to cut directly upon the seat of injection and turn out the medicament which has not yet been absorbed. If the injection is driven into the buttock, the space between the tuber ischii and the crest of the ilium is selected, the seat of each injection being carefully recorded.

As to the number of injections and the length of time during which they should be continued, these are not so well formulated as is the case with inunctions or internal medication. The assertion, at one time vigorously held by a number of practitioners, that syphilis can be permanently and promptly cured by a few injections administered during the early secondary period, is clearly disproved. If reliance is placed upon the hypodermic method, it is safe to assume that mercury must be continued as long as by any other method of administration, and that the quantity of the drug absorbed must be as great. This necessarily implies a continuance of injections for several years, with intervals of rest, depending upon the form of the drug administered and the susceptibility of the patient.

As to the frequency with which injection should be repeated, the soluble preparation should be given every third day, with a rest of one week in three after the first year. The insoluble preparations, such as calomel and gray oil, should be administered once in seven days, with a rest of one month in three.

Of the soluble preparations, the one I have found most serviceable is the following:

℞. Hydrarg. chlor. corros., gr. v (0.3);
Sodii chlor., gr. iij (0.15);
Aquæ destillat., ℥j (30.0).—M.
Sig. A 1 per cent. solution of corrosive mercuric chloride; 10 to 30 minims (0.65–2.0) hypodermically.

A stronger solution than this was so frequently painful that it had to be abandoned. Even this comparatively weak solution will at times occasion so much suffering that patients refuse more than one injection. Some, however, take it for months, complaining little or not at all. The initial dose should be not greater than $\frac{1}{10}$ of a grain —10 drops. This may be increased by 2 drops each injection until the dose of 20 or 30 minims is reached. Beyond this it is not advisable to go, unless symptoms are unusually persistent and resistant.

Of the insoluble salts calomel, gray oil and yellow oxide are the preparations of choice. Calomel is administered in suspension, either in glycerin or in oily menstrua. It and all the insoluble preparations give more pain than the bichloride injections, and are more likely to cause abscess. The drug employed should have been recently sublimed by steam, and should be emulsified in either freshly boiled glycerin, olive oil, or vaseline. The preparation should be conducted under all antiseptic precautions, and the emulsion should be protected against contamination by a sterile cotton plug or rubber stopper. One grain of calomel, repeated once in five or seven days, is the average dose.

The injection mixture may be prepared according to the following formulæ:

℞. Hydrarg. chlor. mit., gr. j (0.05);
Glycerinæ purificat., ♏x (0.65);
Aquæ dest., ♏x (0.65).—M.
Sig. Use as an injection.

℞. Calomel, gr. j (0.05);
Vaseline, ♏xx (1.30).—M.
Mix well and use as an injection.

In place of vaseline, boiled olive oil may be employed.

Gray oil is an emulsion of metallic mercury, and is made by thoroughly mixing lanolin with chloroform, allowing the chloroform to evaporate by triturating, and adding mercury 2 parts to 1 part of the semifluid lanolin. One part of the resulting salve added to 3 parts of olive oil makes the ordinary gray oil. The object of this preparation is to secure minute division of the metal and to maintain complete fluidity; it is usually warmed before being used. From 1 to 2

minims are injected every four to seven days for a month, after which a rest of four to six weeks is given.

Yellow oxide is thus prepared for injection:

℞. Hydrarg. oxid. flav.,	gr. xv (1.0);
Acaciæ,	gr. iv (0.2);
Aquæ dest.,	fl℥j (30.0).—M.

Of this preparation 15 minims are injected at a time. Other insoluble salts of mercury which have been employed and warmly commended are the neutral salicylate in 1- to 1½-grain doses weekly, thymol acetate in 1½-grain doses at from three- to six-day intervals.

Of the insoluble preparations I prefer the following:

℞. Hydrarg. chlor. mit.,	ʒj (4.0);
Petrol. liquid. purificat.,	ʒj (4.0);
Lanolini,	ʒj (4.0).—M.

Sig. Three minims as an average dose.

The insoluble preparations usually require a hypodermic needle with a lumen larger than is necessary for the injection of absolutely fluid media. Nearly all combinations of mercury are likely to cause corrosion of the needle in a short time. This may be avoided by boiling the needle in slightly alkaline water immediately after it is used and washing it out with alcohol.

As to the value of the hypodermic method and the indications for its employment, there seems no reason for believing that it is likely to be adopted as a routine method of treatment in preference to other methods. The indications for its use are: In those cases in which, because of chronic gastro-enteritis or a particularly irritable stomach, all forms of mouth-ingestion are inadmissible and the employment of inunctions is impossible, either because of a sensitive skin or because of the environment of the patient; when from the seat of syphilitic lesion and its rapid advance the patient is threatened either by death or permanent crippling, and it is essential that the constitutional effects of treatment should be felt at the earliest possible moment; when the question of diagnosis must be settled promptly, as in the case of lesion of the tongue presenting some of the features of both gumma and cancer, or of sore upon the genitals not absolutely typical of chancre, and yet resisting local treatment—prompt disappearance of such a sore, together with the adenopathy under mercurial injections, would practically establish the diagnosis. The method is contraindicated when the kidneys are diseased and the patient is suffering from diabetes, marked visceral lesions of any kind, anæmia, or systemic dyscrasia.

The Use of the Iodides.—The value of the iodides in the treatment of syphilis is based on clinical experience. It is well known that these preparations powerfully stimulate the absorbent system; hence there is a partial explanation for their use in the lesions of late syphilis which are particularly characterized by excessive formation of imperfectly organized tissue made up for the most part of a small round-cell infiltrate. As a matter of fact, the iodides are of little service in primary or secondary syphilis, and it is not until the tertiary stage is reached—*i. e.* after eighteen to twenty-four months—that their use is indicated as a matter of routine practice. Exceptionally they may be efficient at a much earlier period.

Mauriac holds that iodides should be employed in the phagedenic forms of the initial lesion; in the beginning of the secondary period; especially to combat the headache and the erosive and ulcerative syphilides; in all the syphiloderms of transition, the papulo-squamous and papulo-tubercular; in all tubercular and all malignant syphilides; in all subdermic syphilitic manifestations; or in gummata or gummatous exudates that break down and ulcerate. He believes that the action of the iodides, though less rapid than that of mercury, is more certain and permanent.

Excepting in those early syphilides which approximate in type tertiary lesions—*i. e.* which are deep, ulcerative, and accompanied by extensive infiltration—the iodides are of such slight service in primary and secondary syphilis that their beneficial effects are more than counterbalanced by the irritation they produce upon the gastro-intestinal tract.

The dose of the iodides is to be measured by the effect produced upon the symptoms. This may lead to the administration of an ounce or even more of the drug daily; usually much smaller doses are efficient.

As to the administration of the drug, it is a point of cardinal importance that it should be given well diluted. At about the eighteenth or twenty-fourth month of syphilis it is the habit of the majority of syphilographers to continue the mercurial treatment, adding to it potassium iodide; this even in the absence of symptoms. Such a practice was perhaps originally based upon the theory that the usefulness of the drug was dependent upon the influence it exerted in rendering soluble and potent the residuum of a prolonged mercurial course and in encouraging its elimination. As far as elimination of mercury is concerned, modern research has failed to corroborate this belief. The reason for the administration of an iodide nevertheless exists, since it is a powerful absorbent, not only causing fatty degeneration and disappearance of huge gummata, but preventing the development of infiltrates.

For what is called the mixed treatment—*i. e.* the administration of mercury and potassium iodide—the formulæ vary in accordance with the method by which the mercury has been given. When the latter drug has been administered either by inunction or hypodermic medication, the iodide may be given in saturated solution, as will be presently described. If the mercury has been administered by the mouth, the following formula will be found serviceable:

℞. Hydrarg. biniodidi, gr. iv (0.2);
Potassii iodidi, ʒss (15.0);
Syr. sarsap. comp., ʒvj (180.0).—M.
Sig. Teaspoonful in half a glass of water three or four times daily.

The quantity of the iodide and of the mercury may be varied to suit the requirements of the case. In the absence of symptoms 15 to 20 grains of iodide a day is as much as need be taken.

As a rule, it is better to give the iodides and mercury separately. For this purpose a saturated solution of iodide of potassium should be ordered, as follows:

℞. Potassii iodidi, ʒv (20.0);
Aquæ, q. s. ad fʒj (30.0).—M.
Sig. Five drops thrice daily in a glass of milk or water, increasing as required.

When advancing tertiary lesions so placed as to jeopardize life and usefulness are present, the dose should be rapidly increased. Thus the initial dose of 5 grains daily may be given to determine whether or not the patient exhibits an idiosyncrasy toward the drug. This dose should be doubled the following day, and thereafter should be increased 10 grains a day, remembering that the cardinal point in toleration, in at least so far as the stomach and intestines are concerned, lies in abundant dilution.

When the drug disagrees, and particularly when it has to be given in colossal doses, it is very well to combine it with essence of pepsin in the proportion of 10 grains to a teaspoonful, or, still better, to put the required number of drops of iodide in a glass of milk, adding essence of pepsin and a little sherry wine or other flavoring matter; the patient then takes the junket, which forms in a few minutes. Thus given, the stomach is extremely tolerant to the drug. At times other combinations of iodine are less irritating and more efficient than the potassium salt. A serviceable formula is the following:

℞. Potassii iodidi,
Sodii iodidi,
Ammonii iodidi, āā. ʒij (8.0);
Syrup. aurantii cort., fʒj (30.0);
Aquæ, q. s. ad fʒvj (180.0).—M.

The rubidium iodide has been warmly commended by Neumann. In the limited trial I have given it it has proven even more irritating than the potassium iodide. Iron iodide is serviceable when anæmia is marked.

It must be remembered that in the case of the iodides the production of slight toxic symptoms does not indicate that the full physiological effects of the drug have been obtained, and that when serious damage is threatened by a specific lesion the drug should not be stopped the moment coryza or other slight toxic effects become manifest. For diagnostic purposes it is often necessary to administer very large doses. Under these there seems good reason for believing that exceptionally infiltrations due to causes other than syphilis will disappear. If, however, distinct lesions are cured by mercury and iodides, this, practically, is sufficient ground for a diagnosis of syphilis.

The indications for the use of iodides are—

1. After two years of treatment with mercury, and in combination with this drug, in doses of 15 to 20 grains a day, provided there are no syphilitic symptoms. Iodides should be continued under these circumstances for six months.

2. In precocious secondary syphilis—*i. e.* when lesions are tertiary in type, affecting fibrous or connective tissues, bones, nerve-cells, or viscera, or when they cause deep ulceration or marked infiltration of the surface.

3. In all forms of tertiary syphilis.

Baths in the Treatment of Syphilis.—Baths are employed either for the purpose of causing absorption of mercury, the drug being held in solution in the bath, or for increasing metabolism and hastening elimination, thus allowing much larger doses of the medicament to be ingested than could otherwise be taken.

Mercurial baths are, under exceptional circumstances, extremely serviceable—thus when the skin-lesions are widespread and of a pustular or ulcerating type, or when, because of easily disordered stomachs and hypersensitive skins, patients do not readily tolerate either internal medication or inunctions.

A partial bath is often employed advantageously when lesions develop in particular regions, as about the buttocks or genitalia or upon the hands and feet.

The strength of the bath should be 1 in 20,000; the water should

be at a temperature of between 80° and 90° F.; the bath should be continued for between one and two hours, the temperature being maintained at a proper degree by the addition of hot water as it is required.

Hot-air, -water, or steam-baths given for the purpose of stimulating metabolism are steadily growing in favor. I have been in the habit of ordering hot baths in the routine treatment of syphilis whenever the patient exhibits no idiosyncrasy against them, and when his circumstances are such that they can be taken. It is highly probable that all the advantages of the thermal springs, excepting those incident to change of air and surroundings, can be obtained by the judicious use of hot baths at home. It is absolutely certain that by their use much larger doses of mercury can be tolerated, and that, as a rule, the general health is markedly improved. The Turkish bath taken daily or three times a week is the most serviceable form of applying heat and moisture. Next in order of efficiency comes the hot-air bath, and, finally, prolonged hot soaking in water (from 108° F.).

Arrangements may be made for the daily hot steam-bath in almost any bathroom or bedroom. At a very moderate expense a box can be constructed of such height and size that a patient sitting on a chair has his body entirely enclosed, with his head thrust through a hole in the top. In this box beneath or behind the chair is placed a gas stove or coal-oil or alcohol lamp. The patient is seated in the box, the lamp is lighted, the door and lid are closed, towels are packed about the opening through which the heat projects. In five to fifteen minutes a dripping perspiration is produced. The patient then takes a cool shower-, sponge- or plunge-bath and dries himself vigorously with a towel. This bath should be taken every morning unless from idiosyncrasy it is found to be weakening. It is usually refreshing, and under it patients gain in weight. Even when these hot vapor-baths are taken, I believe one or two Turkish baths in a week are serviceable.

Borovski, who has made a careful study of the effect of hot baths in the treatment of syphilis, shows that both tepid and hot-water baths as well as those of sulphur and hot air, invariably increase the elimination of mercury in the urine, and that this elimination proceeds more energetically the higher the temperature to which the patient is exposed. He holds that the organism of the patient who has been mercurialized can be entirely freed of the drug by means of the systematic employment of heat, and that mercurial stomatitis can be cured by this agency more quickly than by any other means. Hot-air baths are especially serviceable, since the drug is eliminated through the sweat-glands, which are so powerfully excited. These are especially

to be preferred when it is desirable to clear the patient's system of the drug. The precaution should always be taken when hot baths are given to have an attendant present, since syncope is sometimes produced. In themselves hot baths are powerless to cure syphilis.

Aside from the more careful use of the specific drugs, the avoidance of mercurial intoxication, closer attention to the general condition of the patient, and the treatment of dyscrasia with which the disease may be associated, the therapeutics of syphilis has not been materially changed in recent years. But two suggestions worthy of note have been advanced: one is a different method of administering mercury; the other is the application of a new therapeutic principle to syphilis.

Intravenous Injection.—Bacelli has proposed to give mercury by *intravenous injection of corrosive chloride*, holding that thus the dosage is more accurate and the effect more rapid and powerful than when a much larger amount of the drug is given in other ways. This is the solution he employs:

℞. Hydrarg. chlor. corros., gr. j (0.05);
Sodii chlor., gr. iij (0.15);
Aquæ dest., ℥ij (60.0).—M.
Sig. From 20 minins to a drachm daily by intravenous injection.

The median basilic or cephalic vein is made prominent by winding a fillet about the arm and getting the patient to contract the muscles strongly with the elbow extended. The skin overlying the vein is thoroughly cleansed, and the needle of the syringe, after having been boiled and attached to the filled syringe, is driven directly into the vein. The injection is then made slowly. If it is not painful, and particularly if there is no subcutaneous tumefaction, it has evidently passed into the lumen of the vein and been carried away by the blood.

Intravenous treatment of syphilis has not been tried in a sufficient number of cases to determine its value or its harmlessness. It should be considered as a means of bringing the system rapidly under the influence of mercury when progressive lesions threaten vital organs.

The serum treatment of syphilitic lesions dispenses altogether with mercury and iodide of potassium, and attempts to combat syphilis by injecting into the system an antitoxin which inhibits or destroys the germs of the disease. The commonly accepted theory in regard to immunity from any disease rests on the fact that as a result of the introduction of micro-organisms into the system there are produced substances not only injurious to the host, but also those which neither destroy the micro-organisms themselves nor render the soil in which they grow immune against infection. The clinical history of syphilis

leads us to believe that this immunizing substance is found in the blood of man, and that upon its existence depends, for instance, the resistance which the apparently sound mother of a syphilitic child offers against contracting the disease either from her offspring or from any other source, or the resistance which the apparently sound child of syphilitic parents offers against contracting the disease. It is believed that the protecting serum is filtered through the placenta, and that immunity from maternal syphilis would be observed very much more frequently than is now the case, were it not that through traumatism or inflammation the indirect communication between the maternal and fœtal blood is made direct, and hence not only the immunizing substance, but the active living micro-organisms, are carried from the diseased to the healthy human being, and thus in place of acquiring simple immunity the child has implanted upon it syphilis itself.

It is apparent, since the kidneys are functionless in intra-uterine life, and since the micro-organisms of syphilis exhibit especial virulence when they attack the fœtus, that there should be in the circulation of the child syphilitic at birth both immunizing substances and toxic products in unusual concentration. These may be separated from each other by heat.

On the basis of these considerations Bonaduce conducted a clinical study with blood-serum from children hereditarily syphilitic. The results in a few cases were apparently extremely favorable. Various modifications of the serum treatment have been reported with apparently satisfactory results. It is still, however, absolutely in its experimental stage.

Local Treatment of Syphilis.

The chancre should be kept clean and protected from irritation. It must be remembered that it offers an open granulating surface, hence that infection with the ordinary pyogenic germs may readily take place and involve the lymphatics. Indeed, suppurating bubo from chancre is more common than is generally supposed.

I have already advised that chancres should be removed as soon as they are seen, and that the resulting wound should be closed by suture. This is the best treatment, and, even though it does not abort syphilis, it is followed by prompt healing. Under internal medication healing is, however, very rapid.

When the surgeon believes in allowing the chancre to reach its full development, the germs to become widely diffused through the system, unchecked by specific treatment, and eruptions to develop upon the skin and mucous membrane before the administration of mercury, the chancre may become large and troublesome. Under

these circumstances it should be cleansed night and morning, preferably by spraying it with dilute antiseptic solution, carbolic 1 : 500, bichloride to 1 : 5000, dried, and dusted with calomel and zinc oxide, equal parts of each. If this exhibits a tendency to crust, with retention of discharge beneath and congestion and œdema about the sore, wet dressings or ointments are indicated. Wet dressings are best applied by soaking pledgets of cotton in black-wash, placing them over the sore, and securing them in place by a gauze bandage kept constantly wet with a solution of lead-water and alcohol, equal parts.

A serviceable ointment when the discharge, though moderate, is too free to allow the use of a dusting powder, is—

℞. Ichthyol, ʒss (2.0);
Emplast. hydrarg., ʒiiiss (14.0);
Cerat. resinæ, ʒiv (16.0).—M.
Sig. Locally.

Sluggish granulation should be touched with the solid stick of silver. A tightly adherent pseudo-membrane should be destroyed by nitric acid or acid nitrate of mercury, or should be scraped off with a sharp curette, the part being subsequently cleansed and dressed as already described.

Chancres in which the discharge is extremely slight or those in which there is no ulceration are best protected by a film of cotton kept in place by collodion.

Syphilitic buboes—*i. e.* the enlargement of the lymphatic glands anatomically related to the seat of chancre—are best treated by inunctions of mercurial ointment, a quarter of a drachm being rubbed in daily over each bunch of glands.

The syphilides are benefited by the application of mercury to the surface and the systematic employment of hot baths.

The erythemata respond so promptly to medication that they rarely require local treatment.

Papular syphilides are often obstinate, particularly when they appear in the papulo-squamous form. They yield best to inunction and massage and vapor-baths. Local vaporization is especially serviceable. Thus, when the hand is affected it may be placed in an inverted box which is filled with calomel vapor by means of an alcohol lamp and a small metal dish.

Mucous patches are best avoided by cleanliness; when they appear they may be brushed several times daily with the solid stick of silver nitrate or a 10 per cent. solution of this drug. An antiseptic astringent mouth-wash should be used frequently, together with a mild antiseptic spray. As a mouth-wash diluted tincture of myrrh answers

excellently, a teaspoonful of the myrrh being added to a glass of water. It must be remembered that the appearance of mucous patches usually indicates that mercury is not being absorbed in sufficient dose to control the disease; hence in addition to the local treatment it is wise to push the specific treatment for the time being.

Ulcerative patches in the fauces should be subject to the same treatment as mucous patches.

Scaly patches on the mucous membrane are exceedingly obstinate to treatment, and may persist for weeks or months, nor do they seem to be beneficially affected by pushing general treatment. They sometimes disappear under the stimulant and resolvent effect of iodine, which may be used locally as in the following prescription:

℞. Iodi,	ʒij (8.0);
Potassii iodidi,	ʒiij (12.0);
Glycerinæ,	ʒiij (12.0).—M.
Sig. Apply locally to scaly patches.	

A cauterant effect is usually required, such as that resulting from the application of a 10 per cent. chromic-acid solution or acid mercuric nitrate, one-half strength. The sharp curette is sometimes needed for their removal.

Condylomata may be destroyed by applying to them

℞. Plumbi oxidi,	gr. iv (0.2);
Liquor potassii caust., 33 per cent.,	ʒij (8.0).—M.

Iodoform is then dusted over the surface. In two or three days the crust thus formed comes away. The application may have to be repeated two or three times. Chromic or nitric acid is a more certain cauterant. In mild cases no local treatment is required beyond cleaning and dusting with calomel. Very extensive cases should be shaved off with a knife.

The pustulo- or pustulo-crustaceous syphilides are favorably affected by mercury or vapor baths, supplemented by calomel and zinc ointment.

Tubercular and non-ulcerating gummatous syphilides are best treated locally by the continuous application of mercurial ointment. Absorption seems to be encouraged by the hot-water bag, which may be placed directly upon the dressing which contains the ointment.

Exceptionally, there develops a chronic serpiginous, slowly-spreading, persistent syphilide, which seems to resist all forms of local and general treatment. This lesion may yield to a prolonged bath lasting days or weeks. If this fails, the actual cautery should be tried.

Ulcerating surfaces are treated by the curette and the cautery in

accordance with general surgical principles, and diseased bone is subject to the same surgical treatment as when due to causes other than syphilis.

Hereditary Syphilis.—As in the acquired disease, hereditary syphilis is treated and cured by mercury and potassium iodide. By appropriate treatment directed to the parents, transmission of the disease may often be prevented, though the only sure prophylaxis, and one which the practitioner should invariably advise, is the avoidance of marriage, or certainly the avoidance of paternity, for a period of at least four years after the appearance of a chancre. When patients who are syphilitic marry they should be subject to the most careful and persistent treatment.

If pregnancy should occur from a syphilitic father, the mother should receive constitutional treatment during the entire period of utero-gestation. This is even more imperatively indicated if she has been previously syphilitic or has been infected at the time of conception or shortly before or after this.

Immediately after birth the syphilitic child should be given a mercurial, and specific treatment should be continued with appropriate intervals of rest for at least four years. It would seem wise to lengthen the period even beyond this, giving such children an intermittent course of treatment until past the age of puberty.

The children of syphilitic parents may exhibit lesions of syphilis at birth, may be healthy at birth but in from three to five weeks may develop characteristic symptoms, or may be healthy at birth and remain without any manifestations of syphilis throughout life. To a child exhibiting lesions at birth specific treatment should be given at once. If the child is apparently healthy at birth, it should also be treated at once if the syphilis is maternal and recent and has not received vigorous mercuric treatment. If, however, the syphilis is old, is paternal, and has been vigorously treated, and if, moreover, during the period of utero-gestation the mother has received properly directed specific medication, it is safe to wait for the manifestations of syphilis before treating the child.

In cases not corresponding to either of the types just mentioned it is probably wise to wait for secondary symptoms, in the mean time making a careful examination of the child's blood, and instituting treatment the moment this shows diminution in hæmoglobin and increase of white corpuscles without appreciable cause other than syphilis.

The method of treating a child is as follows: The surface of the belly is washed with castile soap and warm water, then with a saturated solution of boric acid, and is finally dried. Upon the child's binder is spread half a drachm of an ointment made up as follows:

℞. Acid. carbolic., ♏j (0.05);
Ung. hydrarg., ʒij (8.0);
Cosmoline, ℥j (30.0).—M.

The binder is then applied as is usual in infants, and is worn for twenty-four hours, after which the belly is again washed with soap and water, followed with boric acid; ½ drachm of the ointment is rubbed in and the binder again applied. This binder is changed for a fresh one every fourth day.

Should dermatitis result from the prolonged application of the ointment, the inflamed skin should be washed with witch-hazel, dusted with carbolized talc, and the mercury should be administered in the form of inunctions, various surfaces being selected for the rubbings, the dorsal region being the one of choice.

It happens at times that because of the hypersensitive skin inunctions cannot be given. Under such circumstances it is wise to resort to hypodermic medication, a solution of 1 per cent. sublimate being used. The initial dose should be 1 minim, $\frac{1}{100}$ grain, every second day, the quantity being gradually increased to 2, 3, or 4 minims.

If the sublimate injections cannot be administered, medication by the mouth is indicated. Probably the most efficient formula is the following:

℞. Hydrarg. cum cret., gr. iii–iv (0.15–0.2);
Sacchar. albi, gr. iv (0.2).—M.
Div. in chart. No. xij.

One powder three times a day, to be taken soon after nursing.

The mercurial should be continued alone with intermissions for two years, after which, for a period of six months, potassium iodide should be added. The formula suggested by Bumstead and Taylor is—

℞. Hydrarg. biniodidi, gr. j (0.05);
Potassii iodidi, ʒiv (16.0);
Syr. sarsaparillæ comp.,
Aquæ, *āā.* f℥ij (60.0).—M.

Of this mixture a patient over five years old may take half a teaspoonful, the dose being gradually increased to 1½ teaspoonfuls three times a day. For younger children the dose is proportionately diminished. At the time this is being given the mercurial ointment is used externally.

It is probably better to give the iodides separately, a saturated solution being employed, and the drops being administered in milk, which so disguises the taste of the drug that it is taken without dif-

ficulty. The initial dose for a child two years old should be 1 grain three times daily. This may be increased a grain at a time.

It is often wise to employ the iodides considerably before the end of the second year, since hereditary syphilis exhibits a tendency to become tertiary in type even in the early secondary period. Under such circumstances the iodides should be added to mercurial treatment.

In very exceptional cases where inunctions, hypodermic medication, or mouth-administration are impracticable, mercury may be given to the mother with the idea of influencing the child through her milk. This is at best, however, an uncertain and unsatisfactory method of treatment.

The periods of rest in the systematic treatment of a syphilitic child correspond in general with those already described as appropriate in the treatment of syphilis in the adult. The reason for continuing the treatment somewhat longer is founded upon the much greater virulence of hereditary syphilis, and the strong tendency which the disease exhibits to recur at the periods of dentition and before and during puberty.

Parasyphilitic Phenomena.—Though it has been many times repeated that mercury and iodide of potassium will cure syphilis, this must by no means be taken to mean that every person who has suffered from syphilis should be given these drugs for the cure of all maladies from which he may subsequently suffer.

Following syphilis, often by a long interval, are many phenomena which Fournier has aptly termed parasyphilitic. These may be in part due to the destructive effect of the original disease, but are not syphilitic in any other sense, and are not modified in the slightest degree by syphilitic treatment. Thus, herpes is extremely common in those who have had syphilis. Mercury distinctly aggravates it; it is not influenced favorably by any form of treatment.

Headaches are not uncommon in the late tertiary period of syphilis. Often, probably in the majority of cases, they are of inestimable value, being prodromal of grave brain lesions, and leading the practitioner to institute early an active course of treatment which, if sufficiently vigorous and prolonged, will prevent the development of incurable brain lesions. There is, however, another form of headache the prognosis of which, in so far as paralysis or other grave brain lesions are concerned, is not alarming, but which persists for months or years and is aggravated by specific treatment. It corresponds to the neurasthenic type of cephalalgia, and is benefited by the treatment adapted to neurasthenia.

In determining between these two forms of headaches it should be remembered that syphilitic cephalalgia prodromal of brain lesions never lasts more than a few weeks or months before the unmistakable

symptoms of profound brain involvement develop, and that the beneficial effects of vigorous treatment are noted promptly.

In hospital practice, and exceptionally among private patients, the surgeon occasionally sees syphilis manifested in the form of profound cachexia, marked involvement of the liver, spleen, and kidneys, and extensive destruction of the bones and overlying soft parts. Specific treatment avails little in these cases.

Perhaps the safest rule to follow in the late lesions, whether they be of the surface, the viscera, or the nervous, vascular, or respiratory system, is to make one faithful effort with mercury and the iodides. If no improvement is noted, or if, as is often the case, symptoms are aggravated, reliance should be placed upon general tonic and supporting treatment. The trial with the specifics should, however, be thorough and should be conducted under the most favorable circumstances.

In conducting the treatment of syphilis there are rules of procedure to be observed and cardinal facts to be remembered so important that I cannot do better than close my paper by formulating them as follows :

Summary of the Treatment of Syphilis.

1. The constitutional treatment of syphilis should be inaugurated as soon as a probable diagnosis of chancre has been formulated.

2. The first step in the treatment should be the excision of the chancre.

3. Mercury should be the basis of treatment in all periods of syphilis.

4. This is most efficient when administered by inunction.

5. The proper dose of mercury is the largest which can be taken without injury to the health. The development of lesions indicates that an insufficient dose of mercury is being absorbed. When during the course of specific treatment there is steady deterioration in the health, the physician must assure himself that this is not due to mercurialization.

6. A daily hot-air bath enables the patients to take larger doses of mercury than is possible without this form of bathing.

7. Treatment should be continued for at least four years, with appropriate intervals of rest. After the second year a six months' course of iodide of potassium should be added to the mercury.

8. Tertiary symptoms are best treated by a combination of mercury with the iodides.

9. When late tertiaries develop after a four-year course treatment should not be limited to the cure of such tertiaries, but should be continued for at least six months afterward, and should be vigorous. This is particularly important in cerebral syphilis.

10. Parasyphilitic phenomena should not be treated by mercury and the iodides.

11. Patients with syphilis should not be allowed to marry until four years have elapsed from the development of the chancre. Syphilis is transmitted much later than this, but as only a rare exception.

12. A child of syphilitic parents is best protected from inheritance of the disease by vigorous mercurial treatment of the mother during the period of gestation. This treatment must be strictly confined within the toxic limits.

13. Treatment of syphilitic children should continue with intermissions beyond the period of puberty.

TYPHOID FEVER AND MALARIAL DISEASES.

By J. M. ANDERS, M. D., LL. D.

TYPHOID FEVER.

Prophylaxis.—Typhoid fever is dependent upon a peculiar bacillus discovered by Eberth. It is not deemed necessary to adduce any facts or arguments here with a view to establishing the specificity of this disease, but it may be safely assumed that the *bacillus typhosus* has pathogenic power. To prevent the spread of the specific infection is the first duty of the physician who undertakes to treat typhoid fever.

The Typhoid Bacilli Outside of the Body.—Certain points pertaining to the life-history and the more common modes of conveyance of the specific organism should be adduced at the outset. Uffelmann states that pure cultures of the typhoid bacillus, mixed with the fæces, dried and kept under observation a long time, stand the drying test much better than the cholera bacillus. In dried earth, in white sand, and on pieces of clothing the bacillus lives as long as two months. He found that dust from these dry substances will infect gelatin and milk, from which pure cultures may be obtained. This also shows that the atmosphere may be the bearer of the typhoid contagium. Uffelmann further observes that the typhoid bacilli propagate upon the earth's surface, and that they may penetrate to a considerable depth where the soil is repeatedly moistened. On the other hand, it has been shown that certain influences are decidedly hostile to their prolonged external existence. Karlanski found that the bacilli in the excreta exhibited less tenacity of life, owing to the presence of other bacteria, than the bacilli in the pure cultures. Again, air and sunlight shorten their lives.

In water the bacilli preserve their vitality for weeks, and it is generally believed that they grow and multiply in this medium. In competition with saprophytes, however, they disappear from ordinary water in a few days (Osler). The fact is to be emphasized that the most common source of the typhoid poison is the drinking-water supply, and that most epidemics traceable to it have been found to be occasioned by contamination of streams, often leading to reservoirs, wells, or springs. Since the existence of the bacilli in water is limited to a few weeks, more or less constant pollution is necessitated for pro-

tracted epidemics. Freezing does not kill the bacilli, but, on the contrary, they may live in ice for months (Prudden). They have been found by Prudden and Ernst in the water-filters of homes in which typhoid had appeared.

In milk, particularly when fresh, the typhoid bacilli exhibit a rapid growth. While, as before intimated, milk exposed to the air may become directly infected by dust, more often it is polluted by infected water used to dilute the milk or to cleanse the cans. Milk has been justly held responsible for a number of greater or smaller epidemics of typhoid. It is obvious that any article of diet may be contaminated by exposure to an atmosphere containing the contagium, or by the washing of raw vegetables or other food-stuffs with infected water, or by the uncleaned fingers of the patient or nurse. The oyster may become infected during the process of freshening by sewage-polluted water, in which it flourishes. The *bacillus typhosus* will live in the oyster for a considerable period of time.

The Typhoid Bacilli Within the Human Body.—The sufferer from typhoid becomes a distributing focus from which the specific poison may become widely scattered, unless proper precautions be taken. It is a generally accepted fact that the bacillus gains the interior of the body almost invariably through the intestinal canal. As I have said (*supra*), it is ingested chiefly with the drinking-water, less frequently with milk, and rarely with oysters, raw vegetables, fruits, etc. It may also be conveyed to the mouth by the soiled fingers of laundresses, patients, and attendants, and in very rare instances may even be inhaled or communicated by contagion.

The typhoid bacilli leave the body chiefly along with the stools. The urine (when albuminous), the vomitus, and the sputum may also contain them.

Destruction of the Bacilli by Disinfection.—Since the typhoid bacilli have no permanent, independent existence in the outer world, their complete and immediate destruction upon leaving the body constitutes the chief and most certain method of limiting the spread of this now common complaint. This is accomplished by thorough disinfection of the *stools*, *urine*, *vomitus*, and *matters expectorated*, if any. Although the bacilli are found in the urine only when albuminous, and in the vomitus and sputum only exceptionally, these excreta should in all instances be treated promptly and in the same manner as the stools. If the details connected with this process were to be carried out with a rigor proportioned to the real importance of the matter, typhoid could practically be stamped out in the course of a single decade. It is not an exaggeration to claim that our hygienic resources enable us to destroy effectually the pathogenic organism at the moment it escapes from the body.

Disinfectant Solutions.—Of these, chlorinated lime, if of good quality, heads the list. It should contain at least 25 per cent. of available chlorine; and the strength of the solution used should be six ounces to the gallon of water. This has been used by myself with entire satisfaction, both in hospitals and private practice, for many years. Another liquid disinfectant is the solution of mercuric chloride, 1 : 500, acidulated with hydrochloric or tartaric acid. The objection to mercuric chloride for the disinfection of sputa or fæces is that it forms an insoluble compound with albumins (Billings). A solution composed of equal parts of sulphuric or hydrochloric acid and water is efficient. A 5 per cent. solution of carbolic acid is much employed.

Methods of Applying the Disinfectant Solutions.—To secure the reception of the dejections in the bed-pan or other suitable receptacle is the first important step, and the immediate disinfection of them is the second. The chlorinated lime solution is selected. It is my custom to order one pint to be put into the bed-pan before, and from one to two pints (according to the quantity of the dejection) immediately after, the stool has been passed; the whole is thoroughly mixed by stirring and shaking the vessel, while the solid masses are broken up with a stick (which must be burned at once), so that every particle of the matter is directly acted on by the solution. The vessel is then allowed to stand for three hours before it is emptied into the water-closet.

The solution of mercuric chloride may be employed in a similar manner, but the stool after being treated with it must be allowed to stand for six hours, since this is the shortest period in which it can be thoroughly disinfected. The solution of carbolic acid (5 per cent. strength), used rather lavishly in divided portions, followed by shaking in order to thoroughly mix with the contents of the bed-pan, may be used. There is a valid objection to this agent—namely, that it requires twenty-four hours to disinfect a typhoid stool. The mixture of sulphuric or hydrochloric acid and water will effectually kill the bacilli in two hours. The urine is to be treated in the same way and no less rigorously than the stools, and care should be exercised that neither bed- nor body-linen is wetted by it. I employ the chlorinated lime solution for this purpose. The vomitus and sputum (particularly in pneumo-typhoid fever) are to be received into suitable vessels, and the same rigid methods of disinfection applied as in the case of the fæces and urine.

It is advisable to flush the water-closet frequently in order to diminish the corrosive action of the disinfectants upon the house-drain and fittings. If the stools be completely disinfected, it matters not where they are emptied, but in cases in which this precaution has

not been observed, water-closets and privy-vaults may require disinfection. For the latter purpose the liquor zinci chloridi (Pharmacopœia, 1880), containing 170 grains (11.016) of the chloride to the fluidounce, may be employed. Of this, 1 pint may be mixed with 4 gallons of water, and then poured freely into the water-closets, privy-vaults, or cesspools into which the typhoid discharges have been thrown. The saturated solution of the chloride of zinc can readily and extemporaneously be prepared by dissolving common zinc in commercial hydrochloric acid. This may be diluted in the proportion of 1 pint to 3 or 4 gallons of water, when it is ready for use. It is a good plan to sprinkle the surface of the contents of the privy-vault or cesspool with quicklime daily.

Additional Directions to be Given to the Nurse and Attendants.—After a stool the nates are to be wiped with paper, and then more thoroughly cleansed with a small compress-cloth wet with a solution of mercuric chloride (1 : 2000) or of carbolic acid (1 : 40). The bed-pan and hopper are to be washed with a solution of mercuric chloride (1 : 1000), and then wiped dry, while the cloth used must be immediately burned. It should be an invariable rule to change the bed- and body-linen daily, and to change them immediately when soiled. The mattress, which cannot be changed readily, should be protected by a rubber cover. The latter, as well as any of the bed-clothing, are to be changed at once when soiled. The rubber covers, the changed linen, the soiled bed-clothing, and towels should be received on, and wrapped in, a sheet steeped in a 5 per cent. solution of carbolic acid, and removed quickly to the laundry, where the patient's linen and bed-clothing are to be boiled for a half-hour. The rubber sheets (if used) and covers are to be washed with a carbolic-acid solution (1 : 20), after which they should be washed with soft soap, then well aired for from six to eight hours, and, if possible, exposed to the direct rays of the sun. The blankets and bed-spreads are also to be aired from six to eight hours daily. Fitz recommends that the feeding-utensils immediately after using be thoroughly cleansed in boiling water. The corpse, when death occurs, must be wrapped in a sheet wet with a solution of carbolic acid (1 : 20). When the patient has left the hospital or sick-room the mattresses are fumigated, unless they have been carefully protected by the rubber coverings, and in all cases they are to be aired daily for a week. The rubber covers and the bedsteads are to be washed with a solution of mercuric chloride (1 : 1000). Thorough and, if practicable, cross-ventilation of the sick-room in private houses is to be secured for a week before it can be safely reoccupied.

The measures thus far considered and advised are intended to prevent the patient from disseminating the bacilli, and, as I have before stated, they are of paramount importance and of certain

efficacy if conscientiously followed out. The correctness of this view is shown by the indisputable fact that local epidemics have been repeatedly traced to common sources of water-supply or milk-supply which have been contaminated by the excreta of a single typhoid subject. Among notable instances was the epidemic of 1885 at Plymouth, Pa., during which 1200 persons fell ill and 130 died. All of the cases started from a single patient, whose dejecta had not been properly disinfected, but were carelessly disposed of, polluting the water-supply of a portion of the town. Other epidemics, due to defiled water-supply, have been reported by Seneca Egbert, Rodet, Arloing, and Morat, as well as others. Evidence of a practical kind, to show that local epidemics may be due to infected milk, has been furnished by the reports of outbreaks which were traced to this origin by a number of observers (Ballard, Cameron, Almquist, Smith, and Littlejohn). It will be remembered that such outbreaks are due to the use of polluted water for the purpose of diluting the milk, washing the cans, etc.

Municipal and Governmental Means of Prophylaxis.—Once the primary origin of epidemics or endemics of typhoid has been definitely ascertained, the means of arresting their march are readily suggested by competent municipal or State boards of health. Unfortunately, however, the latter bodies are not always empowered by sufficient authority, owing to lack of appreciation on the part of the general public of the importance of correcting sanitary defects and abuses, or of the value of reliable measures calculated to minimize the prevalence of, and death-rate from, enteric fever. The best-directed efforts to ascertain the source of the infection in many sporadic cases, as well as in limited epidemic appearances, are often futile. We are in the habit of attributing these visitations to a greater or less contamination of the water-supply or to defective drainage, although too often, perhaps, erroneously. It must not be forgotten that sporadic cases or slight outbreaks may be due to certain articles of food, particularly the oyster (*vide supra*). Again, in cases of indeterminate source it is often possible to obviate fresh cases by intercepting and destroying the bacilli *en route*, knowing as we do the usual modes of conveyance of the poison. Thus, during the progress of a case of typhoid in a private family the drinking-water and milk used by the patient and other members of the household should be boiled for a half-hour before being ingested. If an epidemic be prevailing, all of the families in the community should adopt the same precautionary measures. New-comers, particularly if they have removed from rural districts to large cities in which typhoid prevails, should use only boiled drinking-water and milk, eschewing at the same time uncooked vegetables, fruits, and oysters.

It is a well-established fact that the returns of the typhoid cases in a city may be regarded as a safe indication of its sanitary status. On the contrary, whatever tends to better the sanitary arrangements of a city tends in a decisive manner to diminish the prevalence of the disease, and this is particularly true of any improvements effected in the water-supply and the sewer-systems. Thus in some large cities purification of the contaminated water-supply has been followed by a remarkable reduction in the death-rate from typhoid; *e.g.* in Vienna from 12.5 per 10,000 to 1.1 per 10,000. The best method of rendering a polluted water-supply pure is by the most recently approved methods of filtration upon a large scale. Whenever practicable, however, an impure water-supply should be replaced by one obtained from the lakes and running streams to be found in the primitive forests of uncivilized mountainous regions.

Medical and sanitary literature also furnishes convincing practical proof of the happy effect of *improved drainage* in lessening the prevalence of typhoid fever. Without stopping to cite special instances, it may safely be stated that perfection of the sewer-system of a city is little less effective in this direction than a reliable water-supply. It is especially noteworthy that the water obtained from streams contaminated with sewage frequently produces typhoid outbreaks, and that the supply derived from a point near to the discharging sewer-mouths is particularly pernicious.

Isolation of Typhoid Patients.—I am of the firm belief that in hospitals it is advisable to isolate typhoid cases so far as possible and to keep them in special wards; in private families in separate apartments, into which none but the attending physcian and nurse should enter. There is incontestable proof that typhoid fever is feebly contagious. Moreover, it obeys the laws of contagious diseases. The preventive treatment must be conducted on the same principle as governs the treatment of other infectious diseases. It must aim to cut off not only the chief, but every, channel of communication from the sick to the healthy, since the demands of hygiene cannot, under less exacting conditions, be fully satisfied.[1]

Preventive Inoculation of Typhoid Fever.—Quite encouraging results have been obtained from preventive inoculations with the typhoid virus. Iwanow[2] has successfully immunized monkeys. Pfeiffer[3] reports favorable experience with inoculations of healthy persons, describing his methods. He believes that this mode of prophylactic treatment promises to render great services in epidemics of typhoid fever and in military camps threatened with the disease.

[1] For illustrative cases see *Phila. Hospital Reports*, 1891, vol. i. p. 149.

[2] *Bolnit-Schnaja gaseta Botkina*, No. 20. [3] *Deutsche med. Woch.*, No. 46.

Treatment.

General Management.—The general conduct of the case is of paramount importance to the sufferer from typhoid fever. To him the skilful trained nurse is a prime necessity. When a good nurse cannot be had, the attending physician must give in writing the directions regarding the disinfection of the excreta, the bed-linen, and utensils, as well as regarding the exhibition of the food, medicines, etc. The patient, so soon as the indications point pretty clearly to this condition, should be put to bed, and kept there continuously in the recumbent posture until the end of the attack. I am convinced that no other measure is comparable, in its favorable influence upon the course of cases of typhoid, particularly in the earlier stages, with absolute bodily rest. On the contrary, it is a matter of common observation that those who feel themselves unable or unwilling to give up until the disease is fully developed present the more serious forms of the affection. A similarly unfavorable influence in the development and course of the disease is noted among patients who are obliged to travel long distances during the invasion period, as well as among those whom it is necessary to remove from their homes to hospitals during the different stages of the disease. The use of the bed-pan and urinal is to be insisted upon, however light the case. Exceptions to this rule are to be made only in the cases of young children.

The patient's *room* should have a sunny exposure, should be large and well-ventilated, though free from strong air-currents. The temperature need not be above 65° F. during the cold season, and the bed may be taken to a cool, shady nook on a porch or gallery during the warm season. The sick-room should be warmed by an open fireplace or by steam heat, in preference to furnace heat, which is unwholesomely dry. Furniture and hangings, unless needed, should be removed. I have never seen any advantage from the occasional removal of the patient's bed from one room to another, but communicating rooms are desirable, since they enable us to secure thorough ventilation of the sick-chamber by opening the windows of the unoccupied room and keeping open the door between the rooms. Perfect cleanliness of the room and of the utensils employed in the case should be attempted. (See Prophylaxis.)

The *bed* should be provided with a woven-wire mattress, upon which should be placed another mattress of hair. A rubber cloth is to be spread beneath the sheet, and it is important that the latter be kept smooth in order to lessen the danger from bed-sores. The seriously ill should lie on an air-cushion, or, better still, a water-bed. To avoid bed-sores the patient should from time to time be also instructed

to turn from his back to either side; the heels and hips should be bathed frequently with a mixture of alum and salt in dilute alcohol. The bed-clothing should be light. I am in the habit of recommending, besides the sheet, one or two thicknesses of woollen blanket, covered by a light counterpane. In summer a sheet usually suffices. The amount of covering should vary, in the same case even, with the changing sensations of the patient.

The mouth and throat should be kept clean, since by so doing we obviate unpleasant and often dangerous complications (aphthous ulcers, thrush, parotitis, inhalation broncho-pneumonia, etc.). In mild cases the patient can attend to this, but not in the severer types, when the nurse or attending physician should wash the mouth several times daily with a solution of boric acid (3 per cent. strength). It is well to spray the throat at equal intervals with a similar solution. Frequent moistening of the tongue, and particularly the lips, with glycerin and water in equal parts gives great comfort to the air-dried surfaces.

The nurse must not be allowed to leave the bedside of a typhoid-fever patient who has manifested the mildest delirium, since when left alone he may leave his bed and display even suicidal tendencies—a not uncommon cause of a fatal termination in cases where this rule is not made absolute. Although the nurse should be of a cheerful demeanor, she is to keep the room quiet and not converse unnecessarily with her charge. She should be instructed to offer the patient cold drinks in small quantities at short intervals, even though he fails to ask for them, since they are not only advantageous, but much relished. I find that ice-water (not too cold) is the most acceptable and perhaps the least objectionable. Lemonade, without much sweetening, and cold or iced tea are also allowable, and cold water, to which a little grape-juice has been added, is, I find, much liked by fever patients. The physician must instruct the nurse as to the number of visitors allowed and the duration of their stay. The profession must realize the very important fact that notwithstanding certain routine measures of treatment typhoid fever is a disease in which good nursing and constant watching are the factors on which chief reliance is to be placed. In this direction the kind aid of the conscientious trained nurse is of inestimable value. She alone can enforce the proper degree of rest; she alone can satisfy the patient's every want, and comfort him thereby; and she alone can protect him from injurious influences, thus averting many accidents and complications under the guidance of the competent physician. The facts embraced in a skilful nurse's report to the physician at his visits are often of greater importance to the latter in forming his judgment as to the condition of the patient than the results of his

own personal investigations, which must be made necessarily at intervals only. On the other hand, the nurse must not be allowed to indicate the medicinal treatment required, other than the simple measures which fall within her province in case of accidents or complications arising, but must report promptly such occurrences or unusual developments to the attending physican.

The Diet.—An appropriate liquid diet is highly serviceable, and the best article of food is milk. It is well to dilute it with water, and, if diarrhœa exists, it should be boiled. The daily quantity should not be less than 3 pints. No absolute rule can be laid down, however, some patients taking and digesting more than others.

It is best to examine the stools, and if curds or (on microscopic examination) numerous fat-globules are seen, the amount should be moderately restricted. If curds or fat are still seen, the milk should be peptonized. Experience teaches that milk is often better taken and better borne when a little brandy, coffee, or tea is added to it. When milk cannot be taken in sufficient amount, whey, skimmed milk, or buttermilk may be tried; also matzoon and koumyss. If these articles be distasteful, we may replace them (wholly or in part) by meat-juices, or broths of various sorts (beef peptones, beef-juices, or beef-essence, chicken broth, mutton broth, etc.), together with one of the standard infant's foods made with milk or water. The use of oyster soup, clam broths, and *consommé* is allowable, if relished by the patient. Albumin-water, prepared by straining egg-white through a cloth and adding an equal part of water, has given much satisfaction in my hands. This, with meat-juice and broths, will often support a patient during the most trying period of the attack. The food should be given regularly throughout in definite quantities and at stated intervals. With the onset of the period of decline the liquid nourishment is to be increased in amount. In light cases the patient need not be awakened if he can sleep at night, but in all instances he should be fed at intervals of two hours during the day, and when the quantity taken at each feeding is very small, nourishment should be given every hour. When milk is not the sole diet, the latter should be varied. Nurses should be told the importance of thoroughly but gently arousing the soporose or stupid patient before giving food, thus lessening the risk of aspiration pneumonia.

Rectal Feeding.—There are typhoid subjects who cannot (on account of vomiting, etc.) take *per os* sufficient nourishment to support life. Under these circumstances we may substitute or supplement the usual method of feeding by rectal alimentation. For this purpose peptonized milk (3 to 4 ounces—96.0 to 128.0), meat-juice (℥ss—16.0), and egg-white may be employed in combination at intervals of four hours. A stimulant may be added also if desired. In a

case reported [1] by me, in which vomiting was a frequent and distressing symptom, prohibiting the introduction of food by the mouth, the patient was nourished at times in part, and again for days together wholly, by *nutrient enemata*, making a good recovery. From the results of my experience in this and several other cases of typhoid I am persuaded that this mode of feeding may be the means of saving life, and that it deserves a more extended trial than has hitherto been accorded it by the profession.

In early convalescence the patient may take well-cooked plain rice, milk toast, entire eggs (diluted), or thin custards. These dishes should not be allowed until the evening temperature has been at the normal grade for one week at least. When defervescence is much prolonged and the patient becomes very weak, the administration of soft food (eggs, finely scraped meat, etc.) is often followed by notable improvement, and is a justifiable procedure. The return to a full solid diet should invariably be very gradual.

STIMULANTS are useful in most cases in the highest degree, but by no means in all. When the heart becomes enfeebled, as shown by the weak, frequent, and sometimes irregular pulse, with indistinctness of the first sound, alcohol should be used regardless of the temperature. In light cases this circulatory indication for the use of alcoholics is the only one presented, and is most apt to be met with at or near the end of the period of defervescence, but there are not a few cases belonging to this category in which no stimulation is required.

Cardiac weakness develops in all the severer forms, and occurs most frequently during the latter part of the second or in the third week of the disease. Nevertheless, at whatever stage of the affection alcohol is indicated, its administration must be promptly instituted. The same indication is invariably encountered in elderly typhoid-fever patients, to whom alcohol must (with rare exceptions) be given as a routine measure. The appearance of certain severe complications (intestinal hæmorrhage, peritonitis, broncho-pneumonia, lobar pneumonia, etc.) calls for the judicious exhibition of stimulants. I desire to direct special attention to the occasional occurrence of sudden collapse of the circulation, independent of intestinal perforation, in the course of typhoid fever, and the great importance of combating it promptly by quickly-acting stimulants.

When nephritis is a complication, I rely chiefly upon digitalis and strychnine as cardiac stimulants, giving alcohol with a sparing hand and only when the above agents fail. Slight febrile albuminuria does not constitute a contraindication to the use of alcohol.

For use in severe types whiskey is the best form of alcohol; in milder ones some good wine, as port, sherry, or madeira. It is well

[1] *International Clinics.*

to begin with a moderate daily quantity, and then increase if necessary, until the indications are fulfilled. If the patient so desires, he may use brandy instead of whiskey. Whilst alcohol is the best spur for a flagging heart, it is of equal value in combating unfavorable nervous symptoms, and the time for commencing its use may be indicated first by the presence of delirium, coma, tremor, twitchings, etc. To persons who have been previously addicted to their use stimulants should be administered throughout, and in a quantity that is to be regulated by its effects, which must be carefully studied in every instance. Their use in connection with the hydrotherapy of this disease will be pointed out in the discussion of this method. In the cases in which the indications are well marked I begin by administering whiskey, ℥ss (16.0), every three hours, in milk or water, and gradually increase both the dose and its frequency until ℥viij (256.0) or more are taken daily, provided its effects be favorable upon the heart and nervous system. Desperate cases may demand yet larger amounts. In rare cases the whiskey may act injuriously, causing aggravation of the symptoms; when it does it should be withdrawn and other forms of stimulants substituted. The above-mentioned threatened collapse may be met by full doses of whiskey ($\frac{1}{2}$ ounce every hour, or even more), combined with strychnine, which should be exhibited subcutaneously, gr. $\frac{1}{15}$ (0.0043), every three hours, till the depression has been in a great measure counteracted, and then should be continued in medium-sized doses, gr. $\frac{1}{30}$ (0.0021), every four hours. Still other cardiac stimulants are worthy of trial for their favorable supplementary action if required in the individual case, and among these are digitalis, sulphuric ether, etc.

SPECIAL MODES OF TREATMENT.

These are various, and, since to consider all of them at length would lead me beyond the scope of the present article I purpose to dwell chiefly upon (*a*) the method of hydrotherapy and (*b*) the symptomatic treatment—a combination of which methods I have employed for a number of years. Intestinal antiseptics are employed, but they form merely a part of the symptomatic plan. The use of this class of remedies does not, therefore, constitute a specific mode of treatment except in the imagination of their warmest advocates. The expectant-symptomatic method does not include here the routine administration of drugs for their prophylactic influence or to prevent the occurrence of complications, etc. The nearest approach to the constant use of a remedy will be found in the case of salol as a bowel antiseptic. As before mentioned, intestinal antiseptics are not entitled to rank as specifics, and this drug is neither given to modify nor to abridge the general course of the disease, but to overcome existing

tympany, and to control, so far as possible, abnormal fermentative processes in the bowel. Quinine is often combined to combat debility (*vide infra*). I shall speak subsequently of other special modes of treatment, though concisely.

Hydrotherapy.—There is at the present day general agreement among medical authors and clinicians that the best mode of treating typhoid fever is by means of the *cold bath*, which was originally introduced by Currie of London (more than a century ago), and reinstated and successfully practised by Brand of Stettin. There are obstacles and inconveniences in the way of carrying out hydrotherapy in private families, but since the convenient and inexpensive portable tubs have been devised by Batt and Furbush of Philadelphia, Burr of Chicago, and others, most of the valid objections to the method have been removed. At all events, the benefits to the patient offered by this method are so great and varied that it becomes the duty of every physician who treats typhoid fever to be prepared to employ it. The beneficial influences of the baths are as follows: (1) They absorb the body-heat directly, thus reducing the temperature and overcoming the ill effects of high fever; this effect is apt to become more marked after a couple of days, than at the start; (2) they improve the nervous symptoms and render the mind clear; they diminish mental dulness, stupor, muscular tremor and twitchings, and induce sleep; (3) they strengthen the heart, thus obviating the danger of sudden circulatory collapse and the consequences of increasing cardiac weakness (hypostatic congestion of the lungs, venous thrombosis, etc.); (4) they stimulate the respirations, whereby the inspirations are deepened and the tendency to pulmonary complications greatly lessened, especially severe bronchitis, lobular pneumonia, etc.; (5) the renal function is invigorated, and, as a result, the elimination of typho-toxins by the kidneys is increased (Roque and Weill); (6) on account of the cleanliness of the skin which they ensure bed-sores rarely occur; (7) they may shorten the stay in the hospital or sick-room, but not the stay in bed, except, perhaps, in the lighter types.

Unquestionably, the good effects of the Brand method receive striking confirmation from statistical reports which have been prepared by Brand himself, Jürgensen, and others abroad, and Baruch, Osler, Wilson, and others at home. According to the warmest European advocates of the method, the mortality is less than 5 per cent., and no deaths occur in cases that come under treatment before the fifth day. The results among American clinicians, however, have been less flattering, though strikingly uniform, and show an average mortality of 7.3 per cent. Of 102 cases of my own treated by cold and graduated cold baths, 8 died—a death-rate of 7.8 per cent. It is to be pointed out that strict Brand method demands the commence-

ment of the cold baths before the fifth day, this being out of the question in civilian hospitals, into which the cases are very generally admitted at a later period of the disease. It can, however, be followed vigorously in private practice (in some instances) and in military hospitals. The latter, according to Baruch, offer the only reliable statistics, because they are obtained from persons of the same sex and very nearly the same age, living under the same environments, eating the same food, doing the same work, rising and going to bed at the same hour.

Hence, while the statistical data of large general hospitals show the cold-bath treatment as giving far better results than any other known method of treatment, they are not a true criterion of the value of hydrotherapy in this disease. Prior to the use of the cold baths the lowest percentage of mortality (13 to 15 per cent.) had been obtained from the expectant-symptomatic plan. The latter, in my experience, constitutes a not unimportant part of the treatment in many instances in which hydrotherapy is practised, but where applicable it varies with the individual instance. I am convinced that the favorable effect on the case-fatality from the timely meeting of the symptomatic indications is usually underestimated, although it is manifestly of subsidiary importance to the cold bath.

The *details* which we will now consider connected with the administration of hydrotherapy are of the utmost importance. The tub is to be brought to the bedside of the patient, and in hospital practice both bed and tub should be screened while the bath is in progress. After removing his night-dress and placing a large napkin about the loins, the patient is lowered into the bath by a sheet held at each corner by an attendant (and, if he be seriously ill, with the least possible disturbance), and there carefully supported and held while in the bath. If he be sleeping, he must be wakened and the bath delayed for ten or fifteen minutes. Young subjects, and adults in light cases, may be handled properly by two persons, but I do not approve of allowing the patient to step from the bed into the bath, however light the case. While he is in the bath the skin surface, particularly that of the back and limbs, is constantly rubbed by the attendants, in order to stimulate the peripheral circulation and, as far as possible, to avert chilliness and discomfort. The head of the patient rests upon a rubber air-cushion. At first he should be kept in the bath from five to eight minutes; later, ten or fifteen minutes, according to the severity of the case. The head and face are bathed at once from a basin, and a cold compress is applied to the forehead. If prominent nervous symptoms be present, often associated with high temperature, water at 70° or lower should be poured from an elevation of about six inches upon the head and nape of the neck several times during the bath.

The ears must be stopped when douching is practised. If, while in the water, the patient complains bitterly of the cold or is very restless, a stimulant may be administered, ℥j (32.0) of whiskey, diluted, and if this fails he must be lifted into the bed and further stimulated. The patient is to be removed from the bath to the bed (previously protected by a blanket and mackintosh covered by a sheet) and wiped off gently, after which the sheet, blanket, etc. are withdrawn and he is covered with a blanket. If reaction be tardy, about an ounce (32.0) of whiskey should be administered and active friction applied to back and extremities. After reaction is established the patient should receive suitable nourishment. If he be very young, highly sensitive, or elderly, it is best to place him at the commencement in water of a temperature of 85° or 90° F., and then gradually cool it down to 80°. After he has become accustomed to the baths he may be immersed in water at the temperature of 80°, to be reduced to 75°, or even 70°, below which it is unnecessary to go save in the rarest instances. This is the gradually cooled bath of Ziemssen.

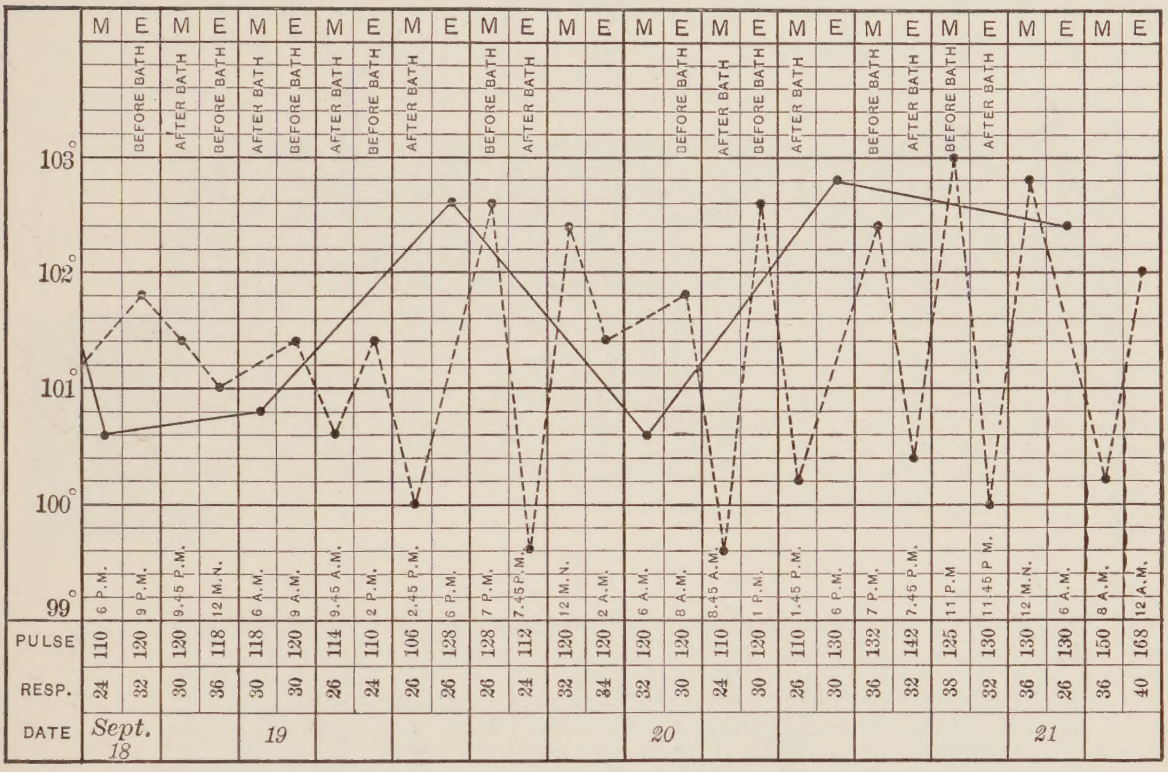
In the rigid Brand method, which is now generally adopted, and which I employ except in the instances above mentioned, the patient is lifted at once into the bath at 70° and kept there for fifteen minutes.

The effect of the bath is best shown by the rectal temperature, which is taken half an hour after the conclusion of the bath, and again half an hour later if the patient be not asleep. Usually, the temperature will be found to be two or three degrees lower than before the plunge. The subjoined charts enable a comparison to be drawn between the temperature-curve in a case treated by cold baths (Fig. 2) and that of another chart (Fig. 3) treated according to the expectant-symptomatic plan. The effect of the bath in producing a decided fall of temperature is noticeable, but about one hour after the tubbing the temperature begins to rise again, and reaches its former level, or almost, at the end of two or three hours. In obstinate and severe cases the fall may be less than one degree, in which case it is advisable to either prolong the bath to twenty minutes or reduce still further the temperature of the water. Protracted warm baths are highly recommended by Reisse and others when cold baths are badly borne or unproductive of good results. In light cases the cold bath should be repeated every six or eight hours; in severe ones, every three or four hours, but more frequently than once in three hours is not advisable even in the worst cases. Sufficient water to immerse the patient to the neck, about 30 gallons (79.2 litres), should be used. During the night the patient should be allowed to sleep for six or eight hours if he can do so.

As before stated, there are a number of convenient and satis-

factory portable tubs in the market, but that devised for me by Dr. C. L. Furbush of Philadelphia (see Fig. 4) possesses certain leading advantages. The frame is made of light wood, and when folded is 4 inches (10.156 cm.) in depth, 14 inches (35.546 cm.) in

FIG. 2.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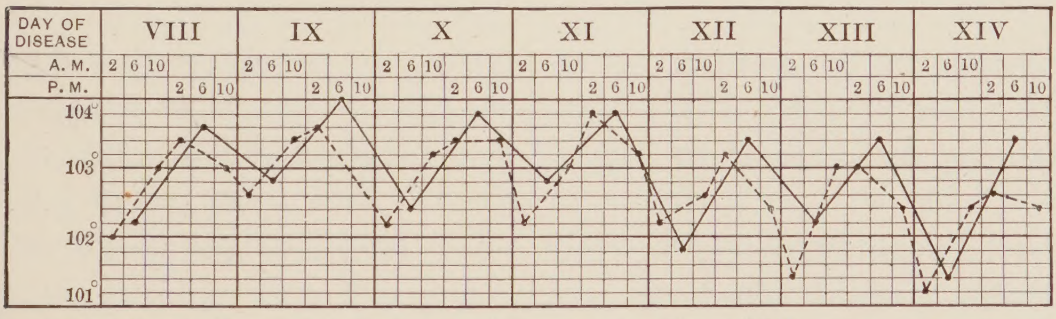
103° 102° 101° 100° 99°
6 P.M. 9 P.M. 9.45 P.M. 12 M.N. 6 A.M. 9 A.M. 9.45 A.M. 2 P.M. 2.45 P.M. 6 P.M. 7 P.M. 7.45 P.M. 12 M.N. 2 A.M. 6 A.M. 8 A.M. 8.45 A.M. 1 P.M. 1.45 P.M. 6 P.M. 7 P.M. 7.45 P.M. 11 P.M 11.45 P.M. 12 M.N. 6 A.M. 8 A.M. 12 A.M.
PULSE 110 120 120 118 118 120 114 110 106 128 128 112 120 120 120 120 110 120 110 130 132 142 125 130 130 130 150 168
RESP. 24 32 30 36 30 30 26 24 26 26 26 24 32 34 32 30 24 30 26 30 36 32 38 32 36 26 36 40
DATE Sept. 18 19 20 21

FIG. 3.

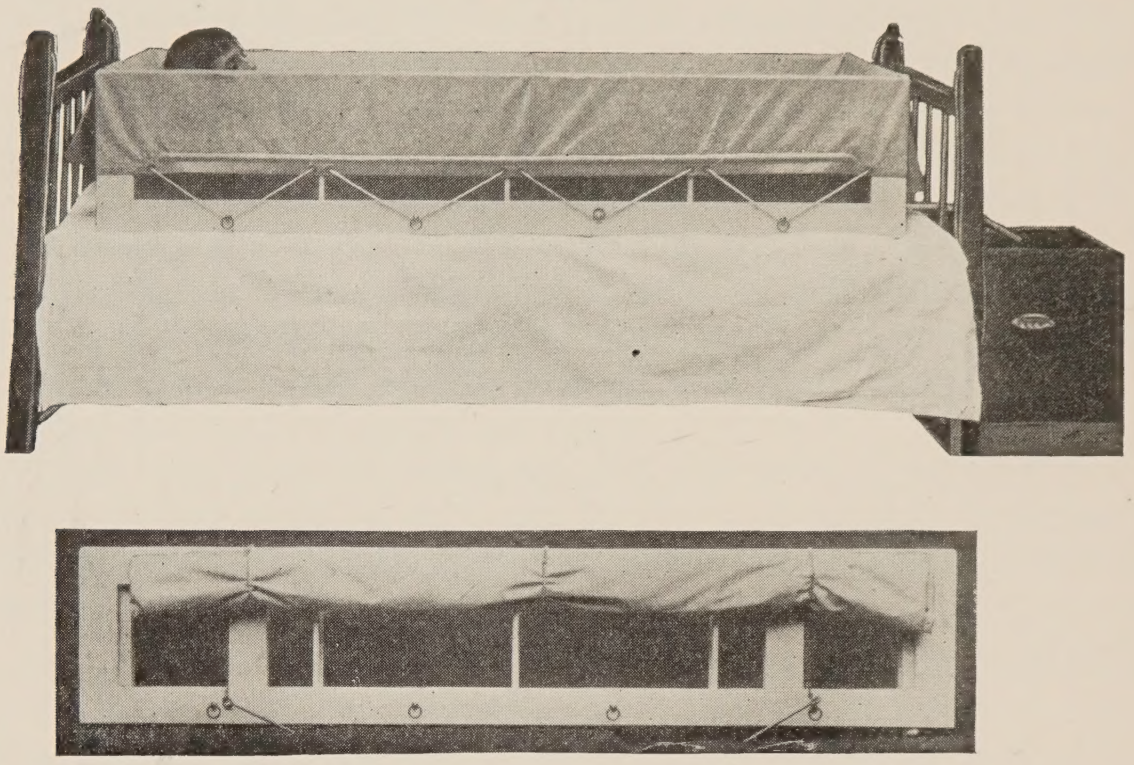


The dotted line indicates hourly temperature record. The solid line shows morning and evening temperature.

width, and 5 feet 10 inches (1.778 m.) in length, so that it can be placed in a closet or beneath a bed. Less than two minutes are required to prepare the bath, which the patient receives while lying in bed. When in use the ends are fastened by brass pins hung on small chains, and these hold the frame in a fixed position. The tub proper is made of double-faced sheeting, reinforced in the middle so as to resist the greatest amount of pressure. The sides of the sheet have a casing through which is passed a wooden rod 4 feet 11 inches long (1.049 metres), and outside of this a margin of $1\frac{1}{2}$ inches (3.808 cm.) is left for the brass eyelets, through which passes a rubber cord which is covered with woven cotton. This cord, which

is attached to the sheet, is held to the frame by special brass fittings along the lower sides of the latter. By the use of the cord and wooden rods we have an even tension on both sides combined with ample resistance to withstand the pressure of the water. An adjustable head-rest fits in the end of the frame. The wooden rod also enables the attendant to roll up the sheet quickly after the bath. Through

FIG. 4.



the bottom of the sheet a rubber 1-inch tube is fitted with a stopper, and by means of this the tub can be emptied much sooner than by a siphon. It is advisable to place two bricks under the legs at the head of the bed. The frame is covered with ivory enamel paint, so that it can be cleansed easily. The entire weight of the tub is 25 pounds (11.33 kgm.).

Whenever practicable, and when contraindications do not exist, baths are to be instituted and carried forward religiously, no matter how mild the case promises to be at the onset. Brand recommends that the baths be commenced when the temperature in the rectum registers 102.2° F. or over. The absolute height of temperature, *per se*, is not to be regarded as an absolute indication for its employment, since the fact must be remembered that the essential effect of the cold bath is a stimulation of the nerve-centres which preside over the organic functions (respiration, circulation, etc.), and that reduction of the temperature is the secondary effect. Moreover, cold baths exert a marked preventive effect, obviating serious symptoms and complications. I continue the baths at increasing intervals until the evening temperature remains below 101° F.

THE CONTRAINDICATIONS to the use of the baths are—(1) *intestinal hæmorrhage*, which is in itself attended with danger, and requires absolute quiet for a time (about four days), when the baths may be resumed if there be no recurrence; (2) *peritonitis*, the occurrence of which always excites suspicion of perforation. Here, again, rest and all that the term implies must be procured; (3) *extreme weakness* of such a degree that the excitement or the handling of the patient necessarily connected with the bath might prove fatal, as I have witnessed in one instance; this condition is sometimes met with in cases that come under observation at a late period, have not been brought under proper treatment from the start, or in cases arising in the aged and in previously enfeebled subjects; (4) cases that have progressed to an *advanced stage* or the third week of the disease should not be immersed. Dangerous and even fatal collapse has been observed to follow cold baths under these circumstances.

Some claim, first, that treatment by the gradually cooled bath is a method entirely distinct from the Brand method, and, secondly, that it is in no wise comparable to the latter in its practical results. To the first of these statements I assent, but not to the second if the graduated bath be employed only in properly selected cases. My own results from the use of the gradually cooled baths have been quite as good as from that of the rigid Brand method when the cases have been chosen in accordance with the rules before laid down. It is true that the number of instances in which the method of Brand is applicable greatly exceeds that in which graduated baths are preferable. I am here simply pleading for the observance of that cardinal therapeutic axiom which recognizes the supreme importance of adapting the means to be employed to the case in hand rather than to the disease in general.

SUBSTITUTES FOR THE COLD BATH.—The prejudice which exists against the cold bath—at least in America—sometimes proves insurmountable. Again, there are many physicians who do not avail themselves of the means at command for carrying out hydrotherapy. In consequence of these facts, substitutes for the cold and the graduated cooled baths, are, unfortunately, quite commonly in vogue. Among them cold sponging of the body of the patient is often resorted to, though it secures for him few and trivial advantages as compared with those of the baths. If this method be employed, the water should be of the temperature of the air of the apartment or ward. The limbs should be sponged and dried in succession, and then the trunk. Whenever the temperature reaches 102.5° F. this measure is to be substituted, each sponging being continued until the desired effect has been produced (a reduction of temperature of one and one-half or two degrees), unless the patient gives signs of uneasi-

ness, when it must be cut short. It may be repeated as often as required. To the water used for the application equal parts of vinegar or spirits should be added. The efficacy of the cool sponging is greatly enhanced by the simultaneous application of the ice-cap, either constantly or during alternate hours.

If this method fails, as it often does in severe types, the cold pack may form a satisfactory substitute. In children the reaction after a cold bath is often delayed and imperfect, and in these instances I have found the cold pack an excellent measure. The patient is placed upon a cot previously prepared by spreading over it a blanket, which is in turn covered with a sheet doubled and wrung out of water of the required temperature (70° to 80° F.). The sheet and blanket are now wrapped about the patient evenly, and he is there left for a period of time varying from a half to one hour. Free diaphoresis generally ensues, and this aids in maintaining the fall of temperature. The effect in most instances is to reduce the body-heat two degrees or more, and the treatment may be repeated at intervals of three or four hours if needful. The wet sheet alone may surround the patient, and be sprinkled at short intervals with a watering-pot containing water of a temperature of 70° F. Besides the mere reduction of temperature, the cold pack exerts a favorable effect upon the nervous system.

In desperate cases, in which cold baths are for adequate reasons out of the question, ice-water enemata may be tried. If carefully administered and not too large, not exceeding 12 fluidounces (384.0), they produce a reduction of the temperature amounting sometimes to two or more degrees.

Leiter's coils may be applied to the head, chest, or abdomen with the hope of lowering the body-temperature. They are made of thin rubber tubing, and form the most convenient mode of obtaining the good effects of cold.

Guaiacol when applied to the skin surface has a potent antipyretic effect, and has been extensively used by McCormick and others for this purpose in the treatment of typhoid. From 10 to 30 minims of the drug are used at each application. I have seen its use followed by unfavorable consequences—rigors, hyperpyrexia, etc.—and H. G. McCormick has adopted the rule not to use more than sufficient to lower the temperature to 100° F., and has thus escaped ill effects altogether.

The Symptomatic Treatment.—This is frequently useful, even in cases treated by cold baths, although often the remedies are needed only occasionally. It may rank as the leading plan of treatment when the Brand baths are not or cannot be carried out. (*a*) The *fever* may reach a high grade and demand treatment; unless the temperature, however, exceeds 104° F. and the morning remissions are

slight, special measures are not required. Hyperpyrexia (105° F. or over) is, if continued, dangerous, and calls for active measures. It must not be forgotten that a comparatively low temperature may very rarely be seen in grave cases. In such the system reacts less violently to the typho-toxins, hence the lower fever, notwithstanding the intense infection. When high temperature presents an indication for treatment, the choice lies between the two classes of agents—external and internal antipyretics. The former ("substitutes for cold bath") have been considered (*vide supra*), and deserve to be tried before the latter. But the substitutes for the cold bath often prove ineffectual, while internal antipyretics reduce the temperature, soothe and moderate the nervous symptoms, and act as more or less potent antiseptics. The most reliable of this group of medicaments (phenacetin, acetanilid, and antipyrin) are open to the serious objection that they depress cardiac power.

When the Brand method, however, cannot be employed, or when, as rarely happens, it is ineffective, and the so-called substitutes for the latter are unavailing, and there is present high fever with decided nervous symptoms, internal antipyretics are allowable if cautiously administered. The safest among them is phenacetin, of which about 5 grains (0.3240) may be given at a dose (preferably about 3 P. M.), and repeated after four hours should the first dose fail of the desired effect. Acetanilid is more effective than phenacetin, but it is not quite so free from injurious action as the latter. It may be prescribed in doses of 2 to 4 grains (0.1296–0.2592), to be followed by a second dose of equal size in four hours if necessary. Larger doses than the above are *attended with danger*, and are not any more effectual. The heart is to be carefully guarded by the use of stimulants when internal antipyretics are exhibited.

Symptoms presented by the Gastro-Intestinal Tract.—*Intestinal antiseptics* are much used with the purpose of destroying the bacillus of Eberth and to counteract the ill effects of its toxins. Unquestionably, they meet neither of these leading indications, but are obviously indicated in the treatment of an affection in which extensive intestinal ulceration and moderate tympanites are usual manifestations. The bowel antiseptic which I have employed quite extensively and with uniformally good results is salol, this drug being broken in the intestinal canal into carbolic and salicylic acids. It controls meteorism as nothing else had done in my hands. The dose is 2 to 3 grains (0.1296–0.1944) every three hours preferably administered in capsule. With it I combine quinine when prostration is well marked in doses of 1 or 2 grains (0.06–0.12) each for the tonic action. Henry speaks strongly in favor of thymol, which he prescribes in pill or capsule, gr. $2\frac{1}{2}$ (0.16) every three or four hours.

I have employed this agent recently, and with gratifying results, in a few cases in which a bowel antiseptic was indicated and in which debility was a prominent feature. Lactophenin, gr. 7 to 15 (0.45–1.0), in starch capsules, up to 1½ drachms (6.0) daily, according to the indications, is highly recommended (von Jaksch).

Turpentine fulfils in some cases a leading indication. When the tongue is dry and brown, the abdomen distended, the general prostration marked, and often muttering delirium present—symptoms of the typhoid state—the use of this agent, together with alcoholics, constitutes the best mode of treatment. Turpentine is best given in a capsule in the form of white turpentine, dose 3 to 5 grains (0.1944–0.3240), every three hours. Its routine administration, however, is to be unqualifiedly condemned.

Tympanites is sometimes a most distressing symptom, and is often associated with marked diarrhœa. It is usually pronounced when the lesions—catarrhal and ulcerative—are situated to some extent or in great part in the large bowel, which is the chief seat of the distention. There are two chief factors which produce tympanites : (*a*) diminution in the resistance of the intestinal and abdominal walls, and (*b*) decomposition of the intestinal contents, owing to lack of the antiseptic power of the digestive secretions. It is rarely so well marked as to interfere with the play of the diaphragm, but even when not excessive it accentuates the danger from perforation. As a remedy for tympanites turpentine is excellent. When employed for this purpose alone I prefer to employ it in the form of stupes applied over the abdomen, although turpentine enemata may also be given, since the gases in severe cases occupy chiefly the large intestine. The enemata may be repeated in ten or twelve hours, and if they fail to relieve a long rectal tube should be passed. Stimulants are, as a rule, indicated in these cases. The meteorism is often increased by the milk taken, so that it is well to predigest the latter. I have found that a change of food from milk to liquid peptones, meat-juice, and albumin-water cures some cases and helps others.

Hæmorrhages from the bowels, however slight, demand prompt and close attention, and complete rest must be immediately secured. The bowel movements, if the hæmorrhage has been copious, must be allowed to pass into the draw-sheet. The ice-bag (suspended if possible) should be applied to the right iliac fossa and ice held constantly in the mouth. Water is not to be taken in large quantities. Opium, to control paristalsis, is our chief reliance among medicinal substances. It should be administered in small doses at *frequent intervals, and by preference hypodermically* or by suppository, until its full physiological effects be secured. It may be combined with full doses of the acetate of lead to arrest the bowel movements. Cases in which slight

oozings appear from time to time are best controlled by the latter combination in pill form. In similar instances turpentine is quite efficacious, and it is also warmly recommended by many authors for use in copious hæmorrhages. Ergotin may be used hypodermically (to be repeated every hour) in severe bleedings. The amount of food should be greatly restricted for about twelve hours. The head of the patient should be lowered by removing the pillows, and the feet elevated by placing blocks under the foot of the bed. If the loss of blood has been excessive, a sterilized normal salt-solution may be introduced by hypodermoclysis, from 4 to 6 ounces (120.0–180.0) being administered at two to four different points.

Since the appearance of the blood in the discharges is preceded by notable fall of temperature, I instruct the nurse to discontinue the baths upon the occurrence of the latter event during the fastigium, and to keep the patient at absolute rest along with the use of the ice-bag until my next visit. Should the sudden depression of temperature be due to other causes, the usual treatment is resumed.

Collapse may follow severe intestinal hæmorrhage, in which case stimulants and other cardiants (strychnine, digitalis, ether, etc.) are to be used, the latter hypodermically. Artificial heat applied to the extremities is helpful.

Peritonitis.—When this complication is due to perforation of the intestine the patient in almost every instance passes quickly beyond relief, though recovery does rarely take place. Kind Nature, without or with the aid of the physician, may possibly limit the inflammation by the formation of adhesions. Morphine should be given hypodermically to relieve suffering, and the laparotomist should be called immediately. Operation offers little hope of cure, on account of the previous unfavorable general and local condition of the patient. With the progress of convalescence the chances of recovery from this accident improve. Peritonitis, due to direct extension of the infectious inflammation of the bowel without perforation, also occurs, and often admits of successful treatment. It is a complication which is difficult to recognize. Unless perforation be suspected, the physician is justified in administering saline purgatives, at the same time controlling pain by means of small doses of morphine, which is without harmful effects, save that it delays somewhat the recovery. Locally, ice-poultices or cold compresses may be used. Turpentine by rectal injection is serviceable if tympany is marked.

Diarrhœa, more than any other single symptom, claims special attention. Two to four movements daily do not constitute diarrhœa, and do not demand treatment. If this number of stools be exceeded, the condition should receive consideration. It may be caused by over-feeding or improper food—as shown by the stools, as a rule—

in which case regulation of the diet is curative. It is often due to catarrhal lesion of the intestines, particularly of the large bowel. Increased peristalsis of the small intestine alone, be it remembered, does not produce diarrhœa. Unquestionably, the use of proper intestinal antiseptics or such as possess the property of insolubility to a high degree is most valuable. Astringents may be combined with the latter or given separately. The subjoined formulæ have yielded better results in my own hands than numerous others which have been tried:

℞. Bismuthi salicylat., ʒij (8.0);
Beta-naphthol, ʒj (4.0).—M.
Ft. capsulæ No. xxiv.
Sig. One to be taken every two or three hours.

℞. Salolis, ʒj (4.0);
Bismuthi subgallat., ʒij (8.0).—M.
Ft. capsulæ No. xxiv.
Sig. One every two or three hours, depending upon the severity of the case.

Or,

℞. Plumbi acetat., gr. xxiv (1.60);
Extr. opii, gr. iss–ij (0.1).—M.
Ft. pil. No. xii.
Sig. One every three or four hours, as required.

The last formula may be administered in the form of a suppository, both ingredients being doubled in quantity. Late in typhoid fever, when the ulcers are fully developed, opium is the remedy *par excellence*, since it tends to arrest the peristaltic action, which keeps up the diarrhœa and favors the spread of the inflammation to the peritoneum. I have recently observed brilliant results in protracted cases in which diarrhea was present from the use of rectal injections of an astringent solution (tannic acid, 1–2 per cent. strength), alternated with an antiseptic solution (salicylic acid, 1–2 per cent.), each given once daily at intervals of twelve hours. These, if administered cautiously and without much force, probably do not increase the liability to perforation, while, on the other hand, they seem to be followed by healing, as shown by the amelioration of urgent symptoms.

Constipation, which is often present, and particularly in the earlier stages, is to be relieved by simple small enemata of soap-suds in water every second day. This form of treatment is specially to be preferred after the ulcers have formed—*i. e.* at the middle of the second week. Calomel may be used in the early stages of dynamic cases. Its employment in this manner may be followed by symptoms

of milder type than are ordinarily encountered. Constipation may be occasioned by a diet which leaves too little residuum to provoke the normal peristalsis of the intestines, and a more voluminous dietary often overcomes the difficulty. The most extensive ulceration of the small bowel may coexist with constipation, the large intestines remaining inactive. This form is best treated by the enemata above described.

Vomiting is rare. Its chief cause is irritation of the gastric mucosa, which may be induced by improper diet or medication. In my experience the best measure for the relief of this symptom, after the removal of the causal factors, is the use of ice, taken in small pieces and swallowed. The oxalate of cerium, combined with the hydrochlorate of cocaine (in small doses), I have found very useful. Some mild form of counter-irritation in the epigastric region may be resorted to. Dry champagne may be given after other things have failed. If vomiting occur during the period of development and is due to the same cause, minute doses of calomel with bicarbonate of sodium may be instituted with good effect. Temporary restriction of the diet is advisable, or a change from milk to liquid peptonoids, egg-white, and animal broths. For the vomiting, which is rarely one of the ushering-in symptoms of the severest types of typhoid, nothing can be recommended with confidence. Two conditions which may cause vomiting in the course of the disease remain to be mentioned: (1) peritonitis, whose treatment has been described (*vide supra*), and (2) acute nephritis. The latter is prone to be a late-appearing complication. It is evidenced not alone by vomiting and other symptoms of uræmia, but by well-marked urinary phenomena (decided albuminuria and the presence of epithelial, granular, and bloody casts). The urine should, for obvious reasons, be examined at intervals of two or three days, although no attention need be paid to the slight febrile albuminuria which is frequently present. I discontinue cold baths when genuine acute nephritis supervenes. Excessive irritability of the stomach calls for absolute rest of the organ for a period of at least twenty-four hours, the patient being meanwhile supported by rectal alimentation and subcutaneous medication. (See also Diet.)

Nervous Symptoms and Complications.—Early in typhoid the *headache* may demand relief. Absolute quiet and cold to the head, however, frequently suffice, and menthol sometimes acts well. Depressant analgesics are to be avoided so far as may be, though it sometimes becomes necessary to resort to them; at such times those least objectionable are to be selected. I have found a mixture containing bromide of sodium, gr. x–xv (0.6480–0.9720), and the deodorized tincture of opium, ♏iij–v (0.1998–0.3330) in each dose, given at intervals of three or four hours, to exercise a strikingly happy influ-

ence. In occasional instances the above mixture fails, and then phenacetin, gr. ij–iij (0.1296–0.1944), may be substituted for the opium in the same combination or separately, in capsule.

Insomnia.—The cold baths or the measures calculated to relieve the headache often procure for the patient refreshing sleep. It is important not to allow the typhoid patient to go too long without sleep, since this tends to favor the development of a pronounced "typhoid state" and its serious concomitants. When the agents recommended for the headache fail, I employ morphine, hypodermically, in small doses, gr. $\frac{1}{8}$–$\frac{1}{16}$ (0.0081–0.0040), during the evening hours, with excellent results. I have yet to witness the unpleasant after-effects or the unfavorable influence upon the secretions that have been described by some authors. Codeine, sulphonal, and, more recently, chloralamid, have proven useful. Chloral is more certain in its action than the above agents, but I have abandoned its use for the reason that in two instances it apparently produced circulatory collapse.

Delirium.—Since the introduction of the Brand tub-baths delirium rarely calls for special medication. I have observed (in common with others), and particularly during the advanced stages, that in cases where circulation was feeble, and in which typho-mania was a prominent feature, the administration of stimulants with a free hand completely dispelled the nervous phenomena. If alcohol fails, ether, ♏x (0.666) at a dose, may be given hypodermically and repeated in one or two hours if required. To combine with the arterial some nervous stimulant (musk, valerian, etc.) will be found serviceable, particularly in cases in which the delirium assumes an hysterical type. Pure musk is an excellent nerve stimulant, and is best given in suppository, dose gr. v–x (0.3240–0.6480). Of special value in meeting the delirium are the bromides, hyoscyamus, the persistent use of ice to the head, and the other agents suggested for the headache and insomnia. Somnolence and stupor are rarely prolonged if cold baths and stimulants are appropriately employed. The cold douching spoken of in connection with hydrotherapy is capital in deep stupor or a comatose condition. Here also prolonged tepid baths, while cold is applied to the head, are worthy of trial.

Meningitis is an exceptional complication, usually developing later and even during convalescence. The measures of greatest value in its treatment are full doses of opium internally, and cold to the head. The extremities should be warmed. If constipation should attend, a mercurial purge, as calomel, should be exhibited and followed by an enema containing glycerin if it fails to act promptly.

Pulmonary Symptoms and Complications.—*Bronchitis* usually attends, but when it is confined to the larger tubes it is ordinarily

moderate, and special measures are entirely unnecessary. If severe and diffuse, its management, as well as that of broncho-pneumonia, to which it leads, are identical (*vide infra*).

Broncho-pneumonia was formerly (under the old régime) the most frequent pulmonary complication. The best means to prevent this are—(*a*) to keep the mouth cleansed; (*b*) to arouse the patient thoroughly before each feeding if somnolent, so as to prevent faulty swallowing; (*c*) to change from time to time the posture of the patient from the dorsal to either lateral decubitus; and (*d*) the use of Brand baths from the start. Should broncho-pneumonia be present, it demands free stimulation and the early and almost constant use of oxygen inhalations. Cold compresses or ice-poultices may be applied over the affected part or parts. The cold baths need not be omitted.

Lobar Pneumonia.—The treatment of complicating lobar pneumonia does not differ from that appropriate in this disease when secondary to other infectious diseases. If hyperpyrexia (105° F. or over) should arise, measures to moderate the temperature in accordance with the rules above laid down should be adopted. The heart's action must be maintained in the best possible condition, and the general nutrition as well.

Hypostatic congestion, when present, is caused chiefly by cardiac and vasomotor weakness, but to some extent it is determined by gravitation, as when the dorsal decubitus is too constantly assumed. The condition is often preventable. To overcome it, after its appearance the decubitis must be changed frequently, and cardiac stimulants freely given or increased in amount if taken previously. It is in this condition of the lung that ergot in full dose does excellent service, in that it raises the blood-pressure in the pulmonary area.

Laryngitis.—For this condition (which rarely develops in typhoid) counter-irritation should be tried, and, if this bring no relief, a small blister may be applied below the angle of the jaw on either side. For œdema of the larynx scarification and the inhalation of simple or medicated steam are measures to be used. Then, should suffocation become imminent, tracheotomy should be performed without delay.

Nose-bleed seldom requires treatment. Occasionally, when this symptom arises late in the course of typhoid, it is protracted and resists ordinary measures. Under the latter circumstances the posterior nares should be plugged before the patient's strength has been in great measure exhausted.

The Circulatory System.—The tendency at times to failure of cardiac power with general adynamia in this disease has previously been emphasized, and the treatment of the condition by measures calculated to sustain the heart and vital powers (strychnine, cocaine

hydrochlorate, ether, musk, etc.) has been indicated with sufficient fulness under the headings "Stimulants," "Intestinal Hemorrhage," and elsewhere. Cardiac complications—endocarditis, pericarditis, and myocarditis—are to be met on general principles.

Thrombosis of the femoral vein is best treated by elevating the part and keeping it at perfect rest. The following ointment may also be applied along the course of the vessel:

℞. Ung. ichthyol.,
Lanolin., āā. ʒss (15.0);
Ung. belladonnæ, q. s. ad ʒij (60.0).—M.
Ft. ung. Sig. Apply three times daily.

After the swelling has subsided an elastic stocking should be worn for a couple of months.

For *retention of urine* the catheter is used. The instrument must be kept thoroughly sterilized. In the female a glass catheter, and in the male one of soft rubber should be selected. That the timely and proper use of the catheter may obviate cystitis, and even nephritis, is, I think, indubitable. Should the latter, which are among the rarest of typhoid complications, arise, they are to be met by the ordinary remedies.

Management of Convalescence.—Some of the points connected with this subject have already been discussed (diet, time for getting up, etc.). I may add that should a recrudescence occur the patient should be kept at rest in the recumbent posture and a return made to the liquid forms of food. Often a moderate laxative serves a good purpose, particularly if an indiscretion in diet has been committed. The ulcers may not be healed, though the temperature may have been normal for a week or ten days, hence the patient should not be allowed to stir about for a period of two weeks after the temperature has returned to the normal. At first his movements should be slow; shortly he may be allowed to exercise gently in the open air during seasons of favorable weather, but mental excitement is to be avoided, since it may produce a recrudescence of fever. Occasionally during convalescence the diarrhœa persists. It is due to colonic ulceration, and is best treated by restricting the diet to milk and other light forms of albuminous food. The patient must be confined to bed. Medical treatment by the oxide of zinc internally, and the use of astringent and antiseptic rectal injections, as before indicated, usually proves successful. Constipation, which may be a troublesome symptom in convalescence, is best relieved by simple enemata. Most patients require tonics. We should begin with a vegetable salt of iron in combination with a simple bitter, as the *infusion* or the *tincture* of

gentian, etc. Later, an inorganic salt of iron with quinine and strychnine in capsules may be resorted to. If a predisposition to tuberculosis exists, cod-liver oil and creasote should be given for a period of a couple of months. Relapses and recurrences are to be treated as primary attacks.

Curative Inoculations with Cultures of Serum.—Among special plans of management this deserves mention. The brilliant results obtained from the use of antitoxic serum in diphtheria and certain other affections have led to attempts at curative inoculations in typhoid fever. But, though their specific virtue is yet to be demonstrated, it is deemed proper to state the results which have been obtained as concisely as possible. E. Fränkel and Manchot have treated 57 cases of typhoid fever with a sterilized liquid derived from the culture of the bacilli of Eberth in thymus bouillon and heated to 60° C. Of this one-half cubic centimetre was injected deeply into the gluteal region. No reaction followed the first injection. The next day one cubic centimetre was introduced into the other buttock. This produced an elevation of temperature with chilliness, followed in three or four hours by decided sinking of the temperature. The fever, however, rose again if the injections were now omitted. Oppositely, when the latter were continued at intervals of two days in augmenting doses (1 c.cm. each day), the fever assumed the remittent type, and disappeared altogether after a few days. The splenic enlargement and roseate spots, however, persisted.

Rumpf, following the methods of Fränkel as to preparation and administration, treated 30 cases of enteric fever with cultures of the bacillus pyocyaneus, with like results. F. Kraus and Bushwell, after treating 12 cases with the sterilized pyocyaneus bouillon, however, concluded that this method possessed no specific curative value.

Hughes and Carter treated a number of cases with blood-serum derived from convalescent cases, but, apart from a decided lowering of temperature, the general course of the disease was not perceptibly modified. More recently Klemperer and Levy have obtained the blood-serum from dogs (after inoculating them with bouillon cultures of typhoid bacilli), and found it to be capable of immunizing susceptible animals, as the guinea-pig, etc., against the potency of active typhoid bacilli, and of curing them when infected. This treatment was employed in 5 cases of human typhoid, all of which pursued a mild course.

Quite recently Pfeiffer and Kolle have shown the presence of a bactericidal substance in the serum of enteric-fever patients, as well as in that of certain immunized animals, but the results of their important researches have furnished a means of diagnosis of the disease rather than a specific means of cure.

Specific Therapeutic Plans.—The intestinal antiseptics have been entered, by some, under this head, but without the slightest clinical, or even theoretical, support. Combined with the use of intestinal antiseptics, eliminant treatment is employed. The latter consists in free evacuation of the bowels daily. So long as it can be shown that the typhoid bacilli do not grow and multiply or generate their poison in the intestines, but in the walls of the latter, in the mesenteric glands and the spleen, the futility of attempting to destroy the specific organism of the disease by the use of this class of remedies is obvious. As Osler pertinently remarks: "No one has been foolish enough yet to claim that the so-called intestinal antiseptics can kill the pathogenic and spare the useful organisms."

Drugs employed as general antiseptics for their specific virtue in this affection—iodine, chlorine, sulphuric acid, etc.—have all been found wanting, and scarcely deserve mere enumeration.

MALARIAL FEVERS.

Prophylaxis.

This embraces two considerations: (*a*) The destruction of the malarial parasites outside of the body, or the modification of the soil, so as to prevent further propagation of the latter; (*b*) Individual prophylaxis.

1. The Destruction of the Malarial Parasites Outside of the Body, or the Modification of the Soil, so as to Prevent the Continued Propagation of the Latter.—Attempts at the direct destruction of the parasites in the outer world must needs, in the present state of medical science, prove futile. But our knowledge of the conditions essential to the development of the malarial poison in the soil should, it seems to me, lead to the successful conversion of malarial into non-malarial soils. These conditions, so far as definitely known, are—

(*a*) *A Certain Degree of Humidity of the Soil.*—It is particularly the swamps that are overflowed at certain seasons and then exposed to the direct influence of the atmosphere, or, more specifically stated, to the *action of oxygen of the air* at certain other seasons, that are breeding-places for malaria. Marshy districts, affording luxuriant vegetation, are equally notorious as malarial foci.

(*b*) *The temperature of the air* is, *per se*, a factor indispensable to the development and multiplication of the malarial germ, since the plasmodium becomes inactive at a temperature below 65° F. On the other hand, plasmodial growths may be arrested by an exalted tem-

perature. Such facts as these explain why malaria is often confined to the lowlands and to estuaries and the deltas of rivers. They enable us to see clearly why certain districts which were formerly liable to the affection should have become, as the result of denudation of the virgin soil and its subsequent drainage and cultivation for considerable periods of time, entirely free from the disease; and, on the other hand, why the upturning of the virgin soil or removing the surface of the latter may be followed by the appearance of malaria in localities in which it has been previously unknown. Whilst the soil may be presupposed to be the natural "home and cradle" of the malarial poison, as well as the essential factor in its development, we are not acquainted, as yet, with all of the telluric conditions upon which its presence or absence depends. In this connection the fact should be emphasized that not all marshy districts are malarial, and again, that the disease has been met with in dry, sandy soils and even on distinctly rocky strata.

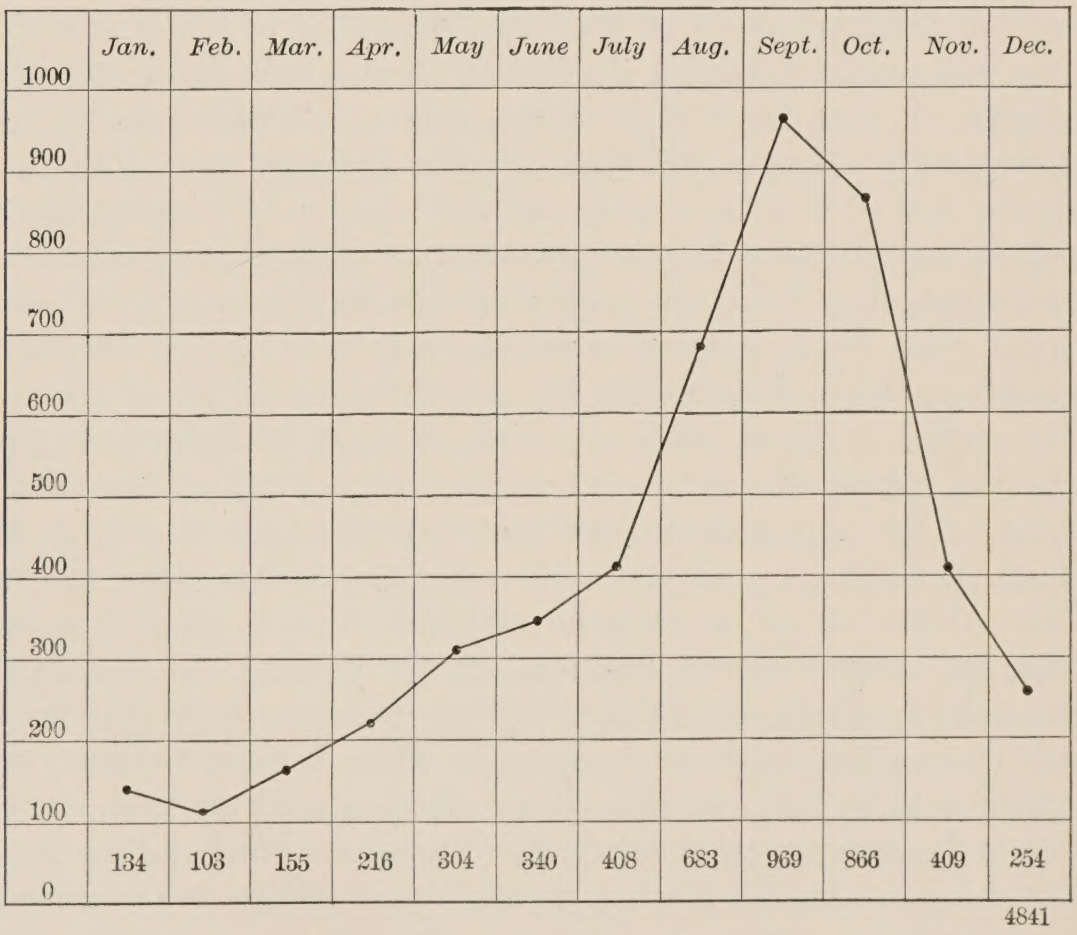
If the concurrence of the above-mentioned conditions is indispensable to the growth and multiplication of the malarial hæmatozoa, then necessarily if a single one of these be wanting the development of malaria becomes impossible. The question arises whether any natural or artificial modes of rendering malarious localities salubrious can be indicated. "Among the various devices which we owe to the ingenuity of man there is, perhaps, none to which attaches more importance than that of drainage."[1] The value of subsoil drainage, with the view of ridding highly malarial regions of their redundant moisture, can be proved by a consensus of eminent opinion, and in consequence of a full appreciation of this fact numerous hydraulic systems have been devised with varying though, on the whole, excellent results. To achieve the same happy object it has been recommended to plant trees, the number to be proportioned to the needs and extent of any special locality, on account of the extreme activity of the transpiratory function exhibited by growing vegetation and the consequent absorption of excessive moisture from the soil. "This application of a scientific principle is best adapted to soils having no natural subsoil drainage, as, for example, in marshy districts, under which conditions rapidly growing trees (eucalyptus globulus, etc.) have a decided effect."[2] There is much evidence of a practical kind to bear out this view. Swamps and morasses are frequent in Ireland, owing to the want of trees to drink up the superfluous moisture (D. Horwitz). In Algeria, according to the observations of Gimlet, extremely malarious districts have been rendered quite harmless in four or six years by the absorbent action of, and evaporation from, the leaves of the eucalyptus globulus. On the

[1] *House-plants as Sanitary Agents*, p. 65, by the author. [2] *Loc. cit.*, p. 263.

other hand, these favorable results have been obtained neither by the French, who have attempted large plantations of the Australian eucalyptus globulus in Africa, nor by the Trappist monks, who made similar trials in Italy. Perhaps the chief reason why seeming advantages were not realized in Africa and Italy lies in the fact that the eucalyptus is cultivated with great difficulty. There are many conditions of climate and soil in which its successful cultivation is impossible. It may be assumed, however, that convincing practical proof of the efficacy of trees in rendering human soil more wholesome is not altogether wanting, and, if not constantly, at least often, when plantations are properly and successfully made. It will be seen that the favorable influence of trees bears only upon one of the three conditions essential to the development of malaria—the reduction of the per centum of ground-water.

It is a remarkable fact that during a dry period following in the wake of a heavy freshet malarial outbreaks are both frequent and severe. This explains in part the constant and pronounced effect of the season upon the prevalence of malaria. Thus, in temperate lati-

FIG. 5.



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tudes most cases occur in the autumn, the maximum number corresponding to the month of September.

This is shown in the accompanying chart (Fig. 5) by the tracing which is based upon 4841 cases of malaria gathered from the records

of the leading hospitals of Philadelphia. In the tropics the case seems to be different, as two maximal periods, spring and autumn, and two minimal, summer and winter, obtain. Autumn has, however, the greatest number of cases. If, as I have attempted to show elsewhere, forests preserve a uniform degree of moisture in their soil, there can be no gainsaying their effectiveness in securing more or less freedom from malarial infection under certain conditions. On the other hand and to an equal degree, the dense forests of the tropical regions, with their luxuriant undergrowth of humble vegetation and their thick covering of vegetable mould in a partial state of decay, render the soil more moist and tend to augment the danger of malaria. The bibulous humus overlying the soil forms an excellent receptacle for the malarial germ in districts naturally malarious, thus placing the plasmodium in conditions most favorable to the influence of the warm climate and the free oxygen of the atmosphere. This observation, although true in the case of the extensive tropical forests, is wholly inapplicable to districts influenced by the presence of plantations under proper care and regulations.

The Mechanical Effects of Trees and Forests in Protecting against Malaria.—It has been remarked by numerous observers that trees in belts or clumps, or even heavy shrubbery, placed between malarial localities and human habitations effectually protect from malarial affections. The wonderful unanimity of the observations recorded by physicians living in paludal districts proves this fact beyond peradventure. A familiar illustration of the influence of the forests in question may be cited here: "A few rows of sunflowers planted between the Washington Observatory and the marshy banks of the Potomac in the opinion of Lieut. Maury have defended the inmates of that establishment from the paroxysmal fevers to which they were formerly liable."[1] In Italy, Maury's experiments have been repeated. "Large plantations of sunflowers have been made upon the alluvial deposits of Oglio, above its entrance into the lake of Isco, near Pisogne, and, it is said, with results favorable to the health of the neighborhood."[2] Another oft-quoted illustration to show the efficiency of trees as intercepters is the clearing away of the forest growth between the Pontine marshes and the city of Rome more than a century ago, at the request of Pope Benedict, and against the recalcitrations of Lancisci, whereupon a decided outbreak of malaria occurred in Rome, some portions of which became uninhabitable.

The question, "How is the effect in question produced?" is pertinent. The late Dr. Flint and Dr. Metcalfe believed that the malarial germ has a peculiar affinity for vegetable life, as well as for organic matter in general, and there is no doubt that the salutary influence

[1] *Loc. cit.*, p. 272.

[2] *Man and Nature*, by G. P. March, pp. 154, 155.

of trees and plantations is effected mechanically. The simple experiments by the late Prof. Tyndall afford a correct interpretation: "He found that the air of enclosed boxes at the expiration of three days no longer contained any of the microscopical particles invariably suspended in ordinary air, these all having attached themselves to the sides of the boxes. Into similar boxes he introduced different infusions of meat and vegetable, which for weeks and months remained unchanged, while, as was to be expected, when the same infusions were exposed to the general atmosphere they speedily underwent decomposition, becoming alive with bacteria."[1] If these observations show that minute air-borne matter has a general affinity for organic surfaces, it can be seen how vegetable growth, by intercepting the atmosphere currents laden with malarial hæmatozoa, would attract to itself the mites carrying the malarial parasites—a practical and mechanical operation.

2. **Individual Prophylaxis.**—To protect successfully from the hæmatozoa is in many cases impossible, and yet, by strict observance of certain rules, the number of instances of malarial fever can be greatly lessened. Of these the avoidance of exposure to the air at night is perhaps the most important. It is well known that the malarial poison is more virulent during the night than the day, and children as well as adults should be protected from its influence. They should not be allowed to go out of doors nor to enter malarial localities after nightfall. Exposure in general predisposes to infection by hæmatozoa, as is clearly shown by the far greater relative frequency of the disease among males than females. I have collected 5044 cases of malaria, which give the numerical proportion of 6 to 1 in favor of the males. On the contrary, it may be plausibly held that when men and women are equally exposed sex is without predisposing influence. Although the relation between the atmospheric humidity and the malarial organism is not definitely known, heavy fogs have been known to be particularly pernicious. Hence sleeping in second or third stories of dwellings is far safer than sleeping on the ground floor in malarial districts. This is accounted for by the fact that while the poison escapes from the soil into the atmospheric strata, it never extends far above the earth's surface, owing to the action of the law of gravitation. Farmers and laborers who must work in malarial localities should pass the nights in dwellings situated upon an elevation, however slight. Persons who are compelled to reside in a malarial district should be careful to select the most favorable site for residence. A high elevation even may protect successfully against paludism. If in a city, the highest points are least apt to suffer, and

[1] "Floating Matter in the Air," by John Tyndall, F. R. S., 1882, quoted by J. F. A. Adams, *Sanitary Forest-culture*, 1884.

densely-built portions enjoy greater safety than those more sparsely settled or than solitary rural homes, for the reasons mentioned in connection with the mechanical influence of trees and plantations. Residence on river-banks (which are liable to overflow) should be avoided. The popular notion that entrance into a mountainous region will cause dormant malaria to develop has been corroborated by physicians, and is an indication, according to H. C. Wood, that deposits are formed in the body. The precautionary measures above pointed out should be rigorously followed by those who have had previous attacks, in order to prevent relapses, which are exceeding prone to occur. The latter arise most frequently in the anæmic, poorly-nourished patients residing in paludal districts. Unquestionably, a generous dietary, along with improved hygienic details of living, is among the agencies most powerful to prevent malarial fevers.

Individual prophylaxis also embraces the use of quinine. Doubtless this remedy is no less potent in preventing malaria than in curing it. Among those who are obliged to live temporarily in malarial districts the use of quinine or cinchonine should be an invariable custom. That it is capable of preventing the development of chills and fever has been abundantly proven by practical observations made in the English navy, as well as by American army surgeons during the War of the Rebellion. The daily dose need not exceed gr. iv (0.2592) of quinine sulphate. Indeed, from personal observations I am convinced that gr. ij–iij (0.1296–0.1944), taken daily, will in most persons bestow immunity from malaria.

In Italy arsenic has been, and still is, much vaunted as a preventive measure. The results of practical experiments with arsenic, however, are somewhat discordant, and it may be safely concluded that it is inferior to quinine as a prophylactic against malaria.

Treatment of Intermittent Fever.

Spontaneous Cure.—At the outset the fact is to be emphasized that the human body possesses natural means of destroying the malarial parasite, and chief among these are the leucocytes. The latter not only accomplish the destruction of some of the parasites during the febrile paroxysms, but also ingest the disintegrated forms after the conclusion of the febrile attacks. Such facts as these go to show that perfect bodily nutrition aids the defensive processes of nature, while a lowered vitality actually hinders spontaneous cure.

Medicinal Treatment.—For the treatment of malarial fevers there is a true specific in *cinchona and its derivatives.* Whilst there are three official varieties of cinchona-bark—gray, yellow, and red—it sometimes happens that they are all derived from one and the same tree. The alkaloids derived from cinchona-bark are various (quinine,

cinchonine, quinidine, etc.), but of these, without question, the salts of quinine are the most certain in their action. As a consequence, quinine is to be given preference in all varieties of malarial fever—intermittent, remittent, continued, and irregular—and, although the substitution of one or more of the remaining alkaloids of cinchona may sometimes prove advantageous, this is only in exceptional cases.

The question "How does quinine cure cases of malarial infection?" needs to be answered. It is to be remembered at the outset that the specific organism causing malaria belongs to a sub-class of protozoa known as hæmatozoa, and that these run their cycle of development within the red corpuscles. The quinine acts directly upon the intra-corpuscular hæmatozoa. This can be observed outside of the body by mixing a drop of a solution of quinine sulphate with a drop of malarial blood. When this has been done it is possible to observe that the hæmatozoa rapidly assume degenerative forms (Laveran). On account of the fact that pernicious, intermittent, remittent, or continued forms of malarial fever—or, in other words, æstivo-autumnal forms—yield less rapidly to the influence of quinine than the simple intermittents, the different varieties would appear to have different degrees of resistance to the action of this drug.

When shall the use of the specific be commenced? There are many reasons, a few of which may be adduced here, why it is desirable to check the course of the disease as early as possible. In the first place, transmission of the simple intermittent into pernicious paroxysms may occur if the disease be allowed to remain untreated for a time. Again, malarial fevers, and particularly the autumnal forms, lead quickly to marked secondary anæmia, and especially so if the patient does not enjoy certain leading hygienic requirements—an abundance of food of good quality, fresh air, sunshine, etc. The blood-changes bring many other disturbances of function in their wake, and rarely initiate that grave blood-disorder, pernicious anæmia. At the present day the tendency is quite prevalent to delay specific treatment for the purpose of making search for the plasmodium, since there is no advantage in commencing the use of quinine during the first paroxysm. During this time the blood may be examined, and this is often needful to complete the diagnosis. Finding the case to be one of malaria, it is my custom to exhibit quinine at the close of the first paroxysm, so as to prevent a recurrence. If the diagnosis of intermittent malaria can be made with reasonable certainty at the physician's first visit, and he has not the opportunity to make a blood-examination at this time, the specific should be commenced at the close of the paroxysm if the patient reside in an infected district. The confirmation afforded to the diagnosis by the anti-malarial influence of quinine is almost

equivalent to finding the plasmodium in the blood, and obviates the ill consequences of unnecessary delay. Circumstances might, however, arise which would warrant a careful study of the blood. Fortunately, these cases occur in districts in which malaria is infrequent, and hence less likely to develop into the severer forms.

During the paroxysm of ordinary malarial intermittents the patient should be kept in bed. The first or cold stage demands plenty of covering and the application of heat externally for their placeboic effect. In the hot stage, cooling drinks, the ice-cap with cold sponging, and light covering are suitable measures. The skin should be carefully dried at the end of the sweating stage. It is only in rare instances that more than one paroxysm is witnessed if the treatment instituted be a proper one.

During the apyrexial interval the patient may be allowed to go about, provided that he is prudent and not too much debilitated. This is the period when the specific remedy is to be exhibited. I have found that a daily quantity of 16 gr. (1.0368) suffices to break the paroxysms in the cases met with in Philadelphia. In protracted cases, in severer forms, and in truly malarial regions the daily amount is to be increased to 20 grains or more (1.2960). Some administer the entire daily quantity at one dose from four to six hours before the succeeding paroxysm is expected, while others give it in divided portions. My own practice has been, in recent years, to administer the remedy in divided doses, and I have obtained more favorable results than with the single large dose which I formerly employed. Immediately following the "sweat" I administer 4 gr. (0.2592), repeating the same dose a few hours later, and the remaining 8 gr. (0.5184), or one-half the daily quantity, six hours before the next paroxysm, the object being to surcharge the blood with the parasitic antidote at the time when the hæmatozoa sporulate. Theoretically, then, the administration of one large dose, administered from four to six hours before the succeeding chill is due, would charge the blood to a greater degree at the required moment than if the same amount were given in three doses, as above recommended. But quinine is slowly absorbed, and still more slowly eliminated from the system. Formerly, when I prescribed single, large, daily doses, I observed not unfrequently unpleasant though slight toxic symptoms—tinnitus aurium, deafness, etc., and nausea even. These rarely arise under my present mode of administering the quinine. The treatment with quinine should not, however, be long continued after the paroxysms have been broken up, and the drug is best given in capsules, followed by a few drops of hydrochloric acid to aid in dissolving it in the stomach. Pills of quinine may be more convenient, and, if made with aromatic sulphuric acid, are equally efficacious, but not unless

freshly prepared. The specific may be also administered in solution, and in this form is more speedily absorbed. The latter, however, is often objected to on account of its unpalatability. When the sulphate of quinine, which is ordinarily employed, fails to give its usual happy results, the hydrochlorate or hydrobromate should be tried ; and the latter salts possess two important advantages over the sulphate, in that they contain a larger percentage of quinine and are more soluble. After the paroxysms cease to recur quinine should be continued in doses of gr. vj–viij (0.3888–0.5184) daily for a few days. On the morning of the eighth day gr. x (0.6480) are to be given, and, if no chill occurs on that day, this dose is to be repeated on the fifteenth, and again on the twenty-second day. If the above dose fails, a larger one is to be administered on the latter two days.

Special Modes of Administering Quinine.—(1) *By Enema.*—If quinine cannot be taken *per os*, enemata containing the remedy may be employed. Each enema consists of gr. xxxvj (1.5552–1.6848) of quinine (adding sufficient tartaric acid to dissolve the latter) in 4 oz. of warm water. Rectal irritability is apt to be produced, however, and absorption is slow and often uncertain ; hence this method of administering the specific is not to be advised, except in cases in which the stomach will not retain the drug, and in which, for some reason or other, it cannot be given hypodermically. The quinine enema must be preceded by a copious simple enema, in order to cleanse thoroughly the mucosa of the bowel. If the medicated enemata be ejected, a few drops of laudanum—*e. g.* ♏v–x (0.333–0.666)—may be added.

By Suppository.—It has long been and still is my custom to administer quinine in the form of suppositories to children who are unable to ingest capsules or pills. This is a more ready method than by enema, and in selected cases may be employed also in adults. In my experience it has not proved any more apt to excite rectal irritation than the quinine enemata. The hydrobromate or hydrochlorate should be chosen instead of the more insoluble sulphate. The dose should be one-third larger than when administered by the mouth, and of course its size must vary with the patient's age. For a child of five years I prescribe a suppository containing 6 gr. (0.3888). At least six hours must be allowed for absorption.

By Hypodermic Injection.—The anti-malarial effects of quinine can be quickly obtained by hypodermic use, and the drug is to be thus administered if there be no time for absorption from the stomach (four hours being the shortest period it is safe to allow), and invariably in pernicious types (*vide infra*). For this purpose the more soluble salts (hydrobromate, neutral hydrochlorate, muriate of quinine and urea, etc.) of quinine are to be preferred to the ordinary and less

soluble sulphate, which requires the aid of an acid to dissolve it. My own preference has been for the following solution:

℞. Quininæ hydrobromat., gr. xii–xv (0.7776–0.9720).
Glycerini pur., ♏ xv (0.999).
Sodii chlor., gr. j (0.0648).
Aq. destillatæ, q. s. ad ʒj (4.0).—M.
Sig. At one dose, to be repeated in pernicious paroxysms.

The subjoined mixture is also much employed:

℞. Quininæ sulphat., ʒss (1.9440).
Glycerini pur., ʒss (1.9440).
Acidi tartarici, gr. xv (0.9720).
Aq. destillat., q. s. ad ʒj (4.0).—M.
Sig. At one dose.

Kobner advocates the following:

℞. Quininæ hydrochlorat., gr. viii–xv (0.5184–0.9720).
Glycerini pur.,
Aq. destillat., *āā.* ʒss (2.0).—M.
Sig. To be injected lukewarm.

It is to be pointed out that unpleasant sequelæ, particularly in the form of abscesses, are apt to result from this method. By the observance of rigid antiseptic precautions, however, these can in a great measure be averted. It is of the utmost importance that the solutions used contain neither micro-organisms nor crystals, and that both the syringe and the skin at the point selected for puncture be carefully sterilized immediately preceding the operation. If the injection be made into the deeper subcutaneous tissue or into the muscle-structure itself, the likelihood of abscess-formation is lessened.

By Intravenous Injection.—This is the most rapid method of introducing quinine into the blood, but if we reckon the longer period of time required for the necessary preparations, little if any time is saved in comparison with the hypodermic method. The risk of serious consequences is also considerable.

The salts of quinine will occasionally fail, and then other preparations of cinchona may be tried. Among these cinchonine is the best substitute. Some contend that this drug has anti-periodic power almost equal to quinine. It is less expensive than the latter, although the dose is one-third larger, and I can speak with confidence of its efficacy after considerable experience in its use in cases where quinine has failed.

In protracted cases of intermittent malarial fever the salts of quinine and other preparations of cinchona sometimes lose their specific influence, when in moderate doses they are to be employed in combination with arsenic. This is especially true of quinine. The dose of arsenic, beginning with ♏ iv, t. i. d., of Fowler's solution, must be increased until the eyelids become decidedly puffy or albuminosity of the urine has been produced. I have found that a granule of arsenous acid may be administered in augmenting doses, commencing with gr. $\frac{1}{30}$ (0.0021), t. i. d., and increasing to the amount finally of gr. $\frac{1}{4}$ (0.0162) daily. So soon as the disease is under control the dose of this remedy is to be diminished, but the drug is not to be withdrawn for several days afterward.

Treatment of Pernicious Intermittents.—(*a*) **Prophylaxis.**—In nearly all instances the occurrence of pernicious paroxysms can be obviated by the institution of prompt and vigorous management. It is specially important to pursue such a course in seasons and localities in which this serious type is known to prevail. Under such circumstances to delay anti-malarial treatment until the second or third paroxysms occur in order to examine the blood is next to criminal.

(*b*) **Treatment of the Pernicious Paroxysm.**—The first attack is to be met promptly by the specific, which is to be administered by the hypodermic method (*vide supra*). In this manner the patient must be fully cinchonized and kept under the influence of the drug for several days, in order to prevent a recurrence, if we would rescue him from imminent danger to life. With the positive, unanimous opinion of English surgeons in India to the effect that no depletory form of treatment is borne in pernicious intermittents I fully agree. On the other hand, supportive measures, particularly vigorous feeding, and the timely use of stimulants when the heart's action becomes feeble, are to be urged.

The *diet* should be liquid, consisting chiefly of milk, animal broths, and egg-white. Liquid peptonoids, predigested milk, etc. may be resorted to as occasion demands. The food is to be given in definite amounts at stated brief intervals. When not sufficient nourishment can be introduced into the system by the usual route on account of the presence of gastric derangement (nausea, vomiting, etc.), which is often marked in these instances, then rectal feeding should be instituted. I have found a combination of the two methods of feeding, rectal and gastric, to work admirably in a couple of instances. I commence to use stimulants when indicated, by administering $\frac{1}{2}$ oz. (16.0) of whiskey or brandy, every two or three hours, augmenting the amount, if the action of the early doses be favorable, until the indication for their use is fully met. It is sometimes necessary to supplement the alcohol by other cardiac stimulants, viz. strychnine,

digitalis, sulphuric ether, etc. The latter are to be exhibited hypodermically.

There are certain other details to be carried out, though of relatively minor importance, and they differ with the varieties of pernicious fever. Thus, in so-called "congestive chills," in which the symptoms of vomiting and purging as well as those of circulatory collapse suddenly supervene, external warmth is highly useful. Morphine, in combination with atropine, administered hypodermically is also of great service, tending to allay the gastro-intestinal symptoms and to warm the extremities. Here, rectal feeding must be resorted to early.

In the **comatose variety**, in which marked nervous symptoms (such as active delirium, rapidly passing into coma) manifest themselves, the fact should be recollected that these alarming features are not due to cerebral congestion, but to the intensity of the infectious process. They are most successfully met by prompt and energetic anti-periodic treatment. Stimulants are to be given with a free hand, but only with a view to bridging the patient over the critical period, and never continuously.

There is a **hæmorrhagic form** of pernicious intermittent, which demands, in addition to the measures above recommended, the use of hæmostatics. In many of these instances malarial hæmaturia is the chief symptom, and its treatment is a therapeutic problem of unsurpassed difficulty, although the question would be much simplified if it were definitely known whether or not the quinine is the cause of the hæmaturia. Plehn,[1] Richardson, and others believe that quinine may produce this symptom, while Steudel and Küchel maintain that this remedy checks the development, and hence the injurious effects, of the malarial parasites. I have met with several instances of hæmaturia, in connection with the milder forms of malaria, in which no quinine had been taken, and have treated them with quinine (gr. xvj daily), a measure which successfully relieved the hæmaturia or hæmoglobinuria. When the latter symptom appears in the course of pernicious types of malaria, it is the custom among many clinicians to administer the quinine in heroic doses.

Two questions arise here: (1) May not the large amount of quinine act as an irritant to the renal tissues, exciting hæmoglobinuria? (2) May not the full doses paralyze the vasomotor nerves of the kidneys and in consequence congestion and hæmaturia supervene? It has been shown that under these circumstances a large quantity of quinine can be easily recovered from the urine. Doubtless, smaller doses of the remedy would often give equally satisfactory results without exposing the patient to added dangers. The specific treatment, therefore,

[1] *Berliner klinische Wochenschrift*, 1895, Nos. 25, 26, 27.

need not be abandoned in these cases, but I maintain that large quantities are not always necessary to effect a cure. Surely, the malarial parasite produces greater loss of blood within the circulatory system by its destructive action upon the red corpuscles than that which takes place through the kidneys. "In actual cases, the daily loss of red corpuscles in the vessels has been found equal to the direct abstraction of two and one-half pints of blood."[1] The cases in which quinine has exercised an injurious effect upon the kidneys have sometimes been those in which the remedy has been too long continued. This fact may be taken advantage of in the treatment of malarial hæmaturia, and the quinine discontinued so soon as the blood has been freed from the hæmatozoa, as shown by microscopic examination. These are the instances in which the interrupted method of administering quinine is to be recommended. Again, I am convinced that it is the part of wisdom to assist vicarious elimination from the bowels. This is the most rational explanation of the beneficial effects which have been derived from the use of calomel, saline purgatives, etc. In this connection the results of a collective investigation by H. A. Hare assisted by Wilmer Krusen are worthy of brief mention. They received 107 replies to questions which were sent out (the area covered giving an average death-rate from malaria of 70 per cent. or over), and of the thirty-two remedies used, calomel, in from 5- to 60-grain doses, seemed to be most in favor. Five other remedies used by ten or more physicians were tincture of ferric chloride, arsenic, ergot, turpentine, and sodium hyposulphite. Tincture of ferric chloride is employed either alone or combined with arsenous acid, or with small doses of quinine. Sodium hyposulphite may be given in from 20- to 40-grain (1.2960–2.5920) doses every three hours, after thorough purgation with calomel. Ergot is much employed as a hæmostatic. Of turpentine, 10 drops every three hours (in capsule), until the urine clears, may be curative, and turpentine liniment is often simultaneously applied to the lumbar region.

Treatment of Remittent Fever.

In this variety, a combination of anti-malarial and eliminant measures is essential. If the physician be called during the first exacerbation, a mild mercurial may advantageously be given at the outset, as follows:

℞. Hydrarg. chlor. mit., gr. ii–iij (0.1296–0.1944);
Sodii bicarbonatis, gr. x–xv (0.6480–0.9720).
Ft. charta No. j.
Sig. To be taken dry, on the tongue.

[1] *Medical News*, Sept. 7, 1895.

This is to be followed on the following morning by a saline laxative —Rochelle salts ʒij (7.776) in concentrated solution. The mercurial should not be given combined with quinine, but it may be repeated during the course of the individual case, as occasion requires. The process of elimination may sometimes be continued by the use of milder laxatives, such as bitartrate of potassium, ʒj–ij (3.888–7.776), in a glass of lemonade, or the patient may be allowed to drink freely of Saratoga vichy. During the exacerbation, cold spongings of the body, together with the ice-cap to the head, are serviceable. For the intense gastric oppression, nausea, and vomiting—when not relieved by the above-mentioned mercurial—chipped ice by the mouth, or small doses of cocaine hydrochlorate, either alone or combined with the oxalate of cerium, may be essayed. A mustard paste may be applied until the skin is slightly reddened, and repeated daily while the gastric features persist. The proper time to begin the use of quinine is during the first remission, and large doses are needed to secure cinchonism, such as gr. xv, to be repeated once or twice daily. The first dose may be given at 4 or 5 A. M., the second at 9 or 10 A. M., and the third, if necessary, during the early afternoon hours. In severe types, a fourth dose of the same size may be required. The object should be to obtain the full physiological effect of the remedy at the beginning of the succeeding exacerbation. If the stomach be non-retentive, or if absorption from this organ be too tardy, the quinine had better be exhibited by the hypodermic method (*vide supra*), or, if more convenient, it may be given by enemata. When the physician is called, after the patient has had one or more febrile paroxysms, the first indication is to establish cinchonism in any period of the exacerbation or remission. Says Bemiss, who has had a long and large experience, "I have seen excessive temperature abated, the dry skin become bathed in healthful perspiration, the tongue grow moist, the delirium cease, and the patient enter at once upon convalescence after a single saturation with quinine." In cases which do not yield to the sovereign remedy, pilocarpine in small doses, gr. $\frac{1}{8}$ to $\frac{1}{16}$ (1.0081 to 0.0108), should be administered hypodermically during the height of the paroxysm. Thus employed, pilocarpine has great therapeutic value: it increases the sweating decidedly, and in consequence renders the remission more marked and more prolonged. In a couple of instances I have observed a remittent fever thus converted into an intermittent one, with light and favorable course. The heart, however, must be carefully guarded when pilocarpine is prescribed, as this drug is an active cardiac depressant.

The remittent cases which have been allowed to drag on for one or two weeks often assume a typhoid character, and such cases are greatly benefited by the use of Warburg's tincture (*vide ante*).

It should be prescribed in doses of one-half ounce, three times daily in the average case, but the doses must be varied, according to the exigencies of the individual cases. After a lapse of several days quinine may be resumed and will be found to prove beneficial, or even curative.

Complications, including local inflammations, are not always controlled by the quinine, but require special measures, the choice of which may be left to the therapeutic judgment of the physician. The strong tendency to renal congestion and suppression of the urine is to be especially emphasized. The leading indication here is to bring about free diaphoresis, by the use of pilocarpine, etc., and cathartics, by means of saline laxatives. I have found, acting upon the suggestion of Page, that a combined steam and hot-water bath is most efficacious in these instances. The patient is placed in a tub of hot water, and then a blanket is put around his neck, its free ends being allowed to extend over the edges of the tub. This may be repeated, if necessary.

The diet should be simple, consisting of milk, meat extracts, or animal broths and the more digestible farinaceous articles. Cooling drinks are grateful, and their palatability may be increased by the addition of raspberry- or lemon-juice. Stimulants are rarely needed in remittent fever, until the stage of convalescence has set in, but in severe and previously neglected cases, indications for their use may be presented early. It is to be recollected that a weak heart calls for stimulants. Of these, brandy or whiskey may be employed, the commencing dose being one-half ounce every three hours. The effects are to be noted carefully, and if beneficial the quantity may be augmented when necessary. When the alcoholics fail, the use of strychnine and digitalis are to be combined with the former. They are best administered hypodermically.

Treatment of Malarial Cachexia.

As in other forms of malaria, so quinine is to be selected first in the treatment of malarial cachexia. It is not, however, to be administered continuously, but at stated intervals. While in charge of the out-patient service in the Episcopal Hospital, Philadelphia, I employed in chronic malarial cachexia and in protracted instances of malarial fever, with very satisfactory results, the sulphate of chinoidine, in daily doses of 30 to 40 grains. In this class of cases, Warburg's tincture (one-half ounce, three times a day) has also been warmly recommended. The eliminant method of treatment is to be combined, and an occasional, though small dose of calomel, followed by a saline laxative, is useful. During the intervals between the latter the milder aperients mentioned under Remittent Fever may suffice. My own experience warrants the belief that full doses of

quinine, given during alternate weeks, is the most successful mode of administering the specific. When this fails, arsenic, which is an especially valuable agent in chronic malaria, is to be added to the treatment. Fowler's solution may be used in augmenting doses, until the daily quantity reaches 30 or 40 minims—gr. $\frac{1}{4}$ (0.0162). If, however, puffiness of the face or albuminuria should appear, the dose should be gradually diminished to 5 minims, which should be continued for a considerable period of time. Another valuable agent is iron, and particularly its vegetable salts, which may be combined with a simple bitter. Few cases are curable, unless the patient leaves the malarial district forever.

For the malarial *anæmia*, which often attains to a severe grade, arsenic in increasing doses has yielded, in my experience, the best results. In a case at present under my care at the Medico-Chirurgical Hospital, the blood-count showed on admission 2,400,000 red corpuscles to the c.cm. Under increasing doses of arsenic, restitution of the red corpuscles was brought about with surprising rapidity; in a single week, while the patient took 8, 9, and 10 minims respectively of Fowler's solution after each meal, the count revealed an increase of from 2,600,000 to 3,500,000. The hæmoglobin, which had been reduced to 45 per cent., was, as is usual, regenerated more gradually. The patient was kept in bed during the first two weeks of his stay in the hospital. He had come from a malarial district in New Jersey. I have never been able to obtain favorable results from efforts at reducing the splenic enlargement. It may be mentioned, however, that iodine, in the form of tincture or ointment, is recommended to be applied over the organ. H. C. Wood advises, for internal use, the solid extract of ergot, in full dose—*i. e.* from 30 to 50 grains (1.944 to 3.240), a day, in capsule.

INFLUENZA.

By H. A. HARE, M. D.

Influenza is a term applied to two separate affections: 1. That arising as the result of infection by some agent as yet not discovered, and usually causing an epidemic of illness characterized by symptoms involving moderate or very severe suffering, and in its malignant types producing secondary affections of great gravity, particularly of the heart and lungs. This malady is true influenza, pandemic influenza, or *la grippe*. 2. The other condition is the general feeling of wretchedness with some aching of the bones or muscles which accompanies an attack of coryza or bad cold. It is with the severe, or epidemic and infectious, form that this article will deal.

In some cases, particularly during an epidemic, the differential diagnosis between true epidemic influenza, when moderate, and the ordinary cold in the head with systemic symptoms is difficult or impossible. Because of this difficulty many cases of "heavy cold" or congestion are classed as being instances of influenza since the great pandemic in the early part of this decade, and it is feared that many other cases, presenting as dominant objective symptoms aching in the bones, rigors, and fever, are diagnosticated as influenza when greater care might reveal that a very different cause for the symptom was present—as obscure tuberculosis, an early stage of enteric fever, or even malarial poisoning or one of the ordinary infectious eruptive diseases. On the other hand, it cannot be denied that since the great pandemic of influenza with which we were visited we see constantly single isolated cases or groups of cases presenting such typical forms of the disease that their identity with the pandemic variety cannot be gainsaid. Often these sporadic cases seem to be quite as malignant as the pandemic ones, and to leave the same vital alterations in tissue and function which that variety of the disease left behind it.

With the description of the general symptomatic picture of epidemic influenza no space will be consumed, for such a description is to be had in any work on practice, and almost every reader of this volume has by this time become familiar with the characteristic manifestations of the malady. However familiar we may be with the clinical aspects of influenza, we have as a profession to confess almost entire ignorance of its etiology and pathology, although its morbid

anatomy has within a few years become better understood owing to the sadly great number of deaths which this infection has produced and which have given us post-mortem findings. Even the autopsy has often failed to reveal any definite lesion peculiar to the disease in itself. In a large proportion of cases the cause of death is found to rest upon the presence of some lesion already existing in moderate degree before the attack of influenza, and which has suddenly become converted into a fatal malady by the development of this curious infectious process. Small and perhaps entirely unknown tubercular deposits in the lungs suddenly become rapidly advancing and fatal lesions; nephritis, limited in its severity, all at once develops into a variety which speedily ends the patient's life; and hearts which have been acting properly for years, although suffering from valvular or other lesion, suddenly break down from rupture of their compensatory hypertrophy. So common are these occurrences that it may be truly said that, while few cases die directly from epidemic influenza, a multitude succumb through the indirect effect of the influenzal poison upon those parts of the body whose vitality has been sufficiently impaired to render them susceptible to its influence. Even if a fatal result does not ensue during the attack it often follows soon after, or even after months or years we find patients stating that though their health had been perfect till the attack came on, they have never been well since. Their present state may be dependent upon some definite lesion in a vital part or be due to a functional disturbance of the heart or digestive apparatus, the cause of which an autopsy, even if it can be had, cannot reveal. The great pandemic of several years ago, like an angry sea, is casting up at the feet of the physician a long line of human beings maimed and permanently injured by the battle they have had with the waves of infection.

While from these facts, and the lack of knowledge as to the cause of the malady, it is evident that our therapeutics when directed to the cure of influenza cannot be very rational, it is also evident that the proper guidance of the patient through his acute illness is of double importance, first, because some serious complication may suddenly end his life, and secondly, because even if he recover from the acute stage he may be so wrecked in health afterward as to be useless to himself and his family. In other words, the physician who is called to see a case of influenza, whether it be of the moderate or the severe type, should never forget that his patient is in some danger, and that his case must receive more watchful attention than that of one suffering from almost any other malady presenting the mild manifestations often met with in this disease. Further, these mild cases, because of an insidious action of the influenzal poison or because of lax care and treatment, are often followed

by the more severe after-effects. The editor of the London *Practitioner* well expressed the necessity of regarding all cases of influenza as worthy of our greatest skill when he said: "One lesson we have learned [about influenza], and that is to avoid the mistake which has too often brought British troops to grief in our little wars, of undervaluing an enemy."

The brusque onset of some cases of influenza and the gradual onset of others may raise suspicions of some other acute infection or even of acute toxæmia on the one hand, or of enteric fever on the other. Often a patient feeling almost as well as usual will be seized with a severe chill amounting in violence to a rigor, and this is followed by violent aching in the back, in the loins, and in the limbs, or throughout the entire body, and a gradually increasing feeling of malaise causes him to seek medical advice. In both classes of cases the febrile movement is usually marked.

In all cases, be their character what it may, one invariable routine measure should at once be insisted on and maintained from the beginning to the end of the attack, and indeed until convalescence is well established, namely, absolute rest in bed.

As already pointed out, the complications of influenza are its most dangerous features, and these complications are usually those which involve the heart, the lungs, or the kidneys. The first of these organs will, in its condition under the infection, be very readily rendered weak, feeble, and irregular if the erect position is maintained and exercise is taken. The other organs are peculiarly susceptible to congestion and inflammation resulting from the chilling of the blood in the relaxed peripheral vessels by the exposure to cold air or even the air of the room. By far the largest number of fatal or severe accidents in true influenza result from ignorance of this important matter of rest and the avoidance of exposure to cold. By remaining in bed the skin is kept warm and aids the kidneys materially in eliminating toxic matter, while its suffusion with blood tends to diminish internal congestion. If a patient refuses to take such rest the physician should at once relieve himself of all responsibility of untoward results by explaining to the patient and his friends the foolhardy risk which the patient is running.

Once the patient is resting in bed the therapeutic rule which the writer of this article is constantly impressing upon the students who attend his lectures holds with force in regard to the function of the attending physician from the beginning to the end of the attack, namely, that "the physician is to be a watchman all the time and a therapeutist only when occasion arises." The old saying, "When in doubt give squills" is capable of producing no good and much harm, but on the other hand, any symptom sufficiently annoying in itself to

merit relief, or any manifestation that any part of the body is suffering from functional disorder of a serious nature, should demand active interference. Just as long as the patient lies fairly comfortably in his bed no other medicine need be given him than small doses of sweet spirit of nitre and citrate of potassium as a diuretic mixture to maintain free urinary flow. If the chill persists after the patient is put to bed hot blankets and hot bottles may be placed around him, and, if it is thought wise, he may also receive a glass of hot lemonade with or without the addition of a little alcoholic stimulant. If the patient is robust and the nervous symptoms are markedly those of excitement, sedatives may be resorted to, both for the nervous symptoms and to stimulate the circulatory apparatus. Thus 5 to 10 grains of Dover's powder may be given, or a little bromide of sodium with some quinine (4 grains) and perhaps a little acetanilide (2 grains). This may be repeated, leaving out the Dover's powder after the first or second dose, if it is desirable owing to the excitement and fever persisting. If constipation is present and the bowels have not been freely moved the Dover's powder should not be given, but a dose of calomel be used and followed in about five hours by a saline purge, after which the remedies suggested just above may be resorted to. The bromide, acetanilide, and quinine may be given every six or eight hours for a day or two, and then it is usually better to discontinue them. Large doses of quinine such as are often given are entirely useless, and commonly increase the discomfort of the patient very materially by reason of the cinchonism which they produce. Further than this, full doses of any of the drugs already named, save calomel, are usually hurtful in that they do not produce any better effects than small ones and are apt to disorder digestion and increase the work of the laboring and perhaps congested kidneys in an effort to eliminate them. This matter of maintaining free kidney secretion cannot be overestimated, both for the sake of the general economy and the kidneys themselves.

As additional measures for the relief of pain and fever the patient may be subjected to a hot or cold pack (see Volume I.), or in its place he may be sponged off with tepid water and alcohol, accompanying the sponging by active frictional rubbing of the tender muscles. In other instances rubbing the back and limbs with chloroform liniment will prove very efficacious, or the following familiar formula may be used for this purpose:

℞. Tinct. aconit., fʒiv (16.0);
Tinct. belladonnæ, fʒij (8.0);
Tinct. opii, fʒiv (16.0);
Liniment. camphoræ, q. s ad fʒvj (180.0).—M.
Sig. Poison. For external use only as directed as a liniment.

If the patient is feeble and depressed, not only hot stimulating drinks should be given him, but in addition some stimulant and sedative mixture, such as the elixir of guarana and celery in the dose of 1 to 4 teaspoonfuls every six or eight hours after taking some nourishment, may be administered. This will relieve headache and neuralgia and stimulate the heart, respiration, and kidneys. Some practitioners use salicin, alone or guarded by a little caffeine or strychnine, for the painful symptoms of the disease. The dose of the former should be 5 to 10 grains three times daily after food, and of the caffeine 1 to 2 grains at the same times.

Sometimes from the very first the patient is so depressed that all other symptoms than his feebleness sink into insignificance and every effort must be used to increase his flagging energies. For this purpose the most valuable remedies are strychnine, caffeine, coca in the form of a good coca wine, kola, and the alcoholic stimulants. Should the general feebleness be alarming and pressing, any of these active agents may be given hypodermically, or, in the case of coca, cocaine may be substituted or ammonium carbonate or aromatic spirit of ammonia given by the mouth. If the heart is feeble and acting irregularly, the use of Hoffman's anodyne is indicated.

It has been the custom of many to give these rapidly acting and powerful stimulants almost constantly from the beginning to the end of the illness. It does not seem to the writer that this is good therapeutics—save, perhaps, in the case of alcohol, which adds force to the body. All these stimulants are in reality spurs which goad the system to make some sudden vital effort. Frequently repeated, they exhaust the vital forces by repeatedly calling upon them, they obtund the reactive abilities of the system, and when a crisis comes, in which the patient must rally all his forces in order to recover, every stimulant has been used, every power has been exhausted, and the result is disastrous.

On the other hand, in the ordinary varieties of depression that we meet with in acute influenza, digitalis has seemed in the writer's hand to possess little value. Indeed, aside from pneumonia there are few acute maladies of the general system in which this drug is valuable. It is a slowly acting heart-tonic.

Diet.—The main factors aiding recovery in the class of cases just described are the digestive function and the maintenance of nutrition. If stimulants are given constantly they should be used more for their local influence upon digestion and assimilation than for their general systemic effect, and should always be given with food and well diluted. If the strength can be preserved by the use of good, nutritious, easily digested food, the chances of the patient are in every respect greatly improved. Concentrated liquid broths made from mutton, beef,

chicken, and veal, to which have been added well-boiled rice or barley strained or made into a pulp, should be given. As little heavy food as possible is to be permitted. The use of milk, while of great service in some cases, should not be pushed in those who have a heavily coated tongue, as it will only cause indigestion; neither should the use of meat broths be persisted in if there is present any active diarrhœa. Acidulous drinks, as of lemon-juice and water with very little sugar, may be given, or barley-water, rice-water, or albumen-water be resorted to, to allay thirst, to soothe the stomach, and to flush the kidneys. One of the most important things in the way of drink is Vichy water from the Celestin spring, or Poland or Londonderry water if the imported Celestin water cannot be had.

Complications.—The treatment for the average, moderately severe, case of influenza from the beginning to the end of the attack, except so far as complications are concerned, has now been considered. Attention has already been called to the fact that these complications are to be avoided by a strict prophylaxis at the beginning and during the attack to its end, including convalescence, and, if the patient is obedient to his physician's directions, in the large proportion of cases he will progress to an early and rapid convalescence. Should he, however, be careless as to these directions, and subject himself to exposure which under ordinary circumstances he would consider no exposure at all, he may at once fall a victim to various complications, single or multiple, any one of which is often sufficiently malignant to cause his death. As an illustration of the rarity with which influenza itself produces a fatal result we may call attention to the interesting fact already emphasized by Bertillon and quoted by Atkinson, that during the epidemic of influenza in Paris in December, 1889, and January, 1890, the deaths from influenza numbered but 213, while the general mortality exceeded the average by 5500; and again, the statistics of Pepper, which show that during this epidemic in Philadelphia only 116 deaths were reported as due to influenza, although the mortality rate of the city rose at a bound to 3044. Pepper only found 84 deaths due to uncomplicated influenza in 35,413 cases. These figures illustrate very well the fact that the complications of the disease are in many instances so severe as to completely mask the true cause of the affection and to convert the case from an ordinary one of influenza into a grave pneumonia, or an equally serious disease of the myocardium.

Probably the most common complication of the ordinary case of influenza is *bronchitis*. Almost always, but not invariably, there is in the early stages of this affection a certain amount of inflammation and irritation of the upper air-passages which, at the first opportunity,

is apt to extend to the larynx and trachea and thence to the bronchial tubes. If a bronchitis is developed the treatment ordinarily instituted for this affection must be resorted to, save in this important respect—that as a rule all sedatives to the nervous and circulatory systems are contraindicated, since at this stage of the disease the asthenic manifestations of the influenzal infection are usually prominent. For this reason antimony, aconite, veratrum viride, very large doses of the potassium salts and of ipecac are usually inadvisable, and the physician in the early stages of the bronchitis must rely chiefly upon the inhalation of medicated vapors or medicated steam, the use of counter-irritants over the sternum and between the shoulder-blades, the rest in bed that we have already insisted upon, and the administration of hot drinks, or a Dover's powder, for the purpose of producing relaxation of the skin and causing a certain amount of perspiration.

If the bronchial inflammation is once thoroughly established and the stage of secretion is developed, then the various stimulant expectorants are as valuable as they are in the ordinary case of bronchitis, notably such drugs as the chloride of ammonium, the various balsams, as for example oleoresin of cubebs and copaiba, terebene, the oil of sandalwood, and similar substances. Should the cough at any stage be excessive, small doses of codeine are probably the best means of controlling it, but later on in the attack, whether the secretion be fairly profuse or not, it has been the experience of the writer that the oil of sandalwood in 5-minim capsules, given in the dose of one or two capsules three times a day—that is, every eight hours—are most efficacious in relieving the cough and aiding in the expectoration.

Very rarely will there be any serious impairment of cardiac power in such an attack of bronchitis, but should there be an extension of the inflammation to the smaller bronchial tubes, with the development of broncho-pneumonia, the case at once becomes very much more serious, not only because of the condition of the pulmonary apparatus, but also because these cases are very apt to develop more or less serious symptoms, which in some cases seem to be almost purely functional and in others apparently rest upon serious changes in the cardiac ganglia and myocardium. It is in such a case that the greatest skill of the physician is required, for very frequently a condition of profound adynamia is developed from which it seems impossible to arouse the patient. It is at this time that full doses of strychnine given for a day or two seem to produce a most beneficient result. Under these circumstances this drug should be given freely, and usually hypodermically. It may be assisted materially by the simultaneous administration by the mouth of moderately full doses of aromatic spirit of ammonia, well diluted with water. As much pre-

digested food as the patient can assimilate should also be given. Oxygen inhalations often seem advantageous and sometimes sharp counter-irritation over the portion of the lung which seems to be most involved, by means of a blister—or, better still, by a dry cup, never a wet cup—produces good results. If the condition of cardiac feebleness persists digitalis may also be given, but the presence of much fever renders its administration almost futile. Should there be little secretion in the bronchial tubes and great restlessness with nervous jactitation, morphine may be given, by the mouth or hypodermically, for the purpose of producing sleep and giving the patient the much-to-be-desired rest, but should the bronchial secretion be profuse the administration of morphine may result in the development of a considerable amount of cyanosis by the arrest of the cough and the consequent decrease in expectoration.

The physician who is on the watch for *pulmonary complications* in influenza will often find that at the base or apex of one lung there is an area in which the physical signs of pneumonia are quite marked; the patient in addition may be expectorating the characteristic rusty or bloody expectoration which is sometimes seen in croupous pneumonia. But he will be surprised to find at the end of twenty-four or forty-eight hours that the area previously diseased seems to have cleared up, and that another spot at a considerable distance from the original site has apparently become involved in the same process. In other words, the patient seems to suffer from fugitive pulmonary congestions. Whatever their actual pathology may be, clinically we meet with many such instances in practice. They are usually associated with feeble cardiac action, and require active stimulant treatment such as we have already described.

In some cases the pulmonary system entirely escapes the results of infection, and the *heart* alone is infected. The cardiac affection may manifest itself by great tachycardia, or in other cases by slowing of the heart's action. Perhaps more commonly still this viscus suffers from an arrhythmia evidently dependent upon some disturbance in its nervous government. Or it becomes exceedingly feeble in its action, is easily perverted in its function by any movement upon the part of the patient; and to such an extent may this cardiac disturbance develop that any effort to lift the head from the pillow results in threatened or complete syncope. Here, again, the physician must be most cautious in his handling of the patient. All movements calculated to throw an extra strain upon the heart must be absolutely prohibited, for it would seem probable that the nervous ganglia of the heart in such a case are affected very much as they are in some cases of diphtheria, in which a sudden movement may result in the instant death of the patient, while complete and prolonged rest often results

in complete recovery. Many of the cases of cardiac disturbance following influenza seem to depend for their continuance upon the fact that the patient has gotten out of bed, or exercised, before recovery from the acute cardiac disorder has been complete.

For the tachycardia the writer has usually found that some one of the following prescriptions give the best results, according to the condition of the cardiac muscle. If the muscle seems sufficiently strong and its action is irregular the following may be given :

℞. Tinct. aconiti, ♏xxiv (1.6);
Tinct. belladonnæ, ♏xlviij (3.0);
Tinct. digital., ♏xxiv vel xlviij (1.6–3.0);
Tinct. gentian. comp., q. s. ad f℥iij (90.0).—M.
Sig. A teaspoonful every six or eight hours—that is, three or four times a day.

In this prescription we get the regulating influence of digitalis, but its stimulant influence upon the heart is largely set aside by its antagonist aconite; the belladonna acts as a vasomotor and cardiac regulator and sedative, and the gentian acts as a simple bitter tonic to the stomach and as a vehicle for the more powerful remedies.

If the heart seems to be lacking somewhat in strength and also suffering from arrhythmia, the following may be used :

℞. Tinct. strophanthi, f℥j vel ij (4.0–8.0);
Tinct. cactus grandifloræ, f℥j vel ij (4.0–8.0);
Tinct. belladonnæ, f℥ss vel j (2.0–4.0);
Tinct. gentian. comp., q. s. ad f℥iij (90.0).—M.
Sig. One teaspoonful every six or eight hours.

Or in some instances it may be well to supplant one of these ingredients by the tincture of nux vomica, or to add the latter to the prescription given above. In still other instances the tincture or fluid extract of convallaria may be used as a cardiac regulator. Should there be marked valvular disease of the heart, larger doses of digitalis are advisable, provided that compensation is ruptured. Further, alcoholic stimulants are particularly useful in this class of cases, but the danger of developing the alcoholic habit is not to be forgotten, and the same objection stands in the way of administering coca and similar stimulants continuously. A belladonna plaster applied over the heart in many cases of cardiac arrhythmia following influenza is of great advantage, and in very severe cases an ice-bag applied to the præcordium is very beneficial for the same purpose. Should the kidneys be impaired and the urinary secretion scanty, small doses of gin,

from one to two teaspoonfuls, given every three hours, may be advantageous.

Should severe *diarrhœa* become a dangerous complication in influenza it must be controlled by the ordinary measures which are employed for this condition.

Quite commonly during the attack and particularly in convalescence from influenza, the patient suffers from various *nervous symptoms*, of which the chief one is perhaps insomnia. By far the best remedies for this condition are the avoidance of all business worry and care, the constant leading of an out-door life, as much horseback or other moderate exercise as can be resorted to within reasonable limits, the use of hot and cold douches as described in Dr. Baruch's article on hydrotherapy, and, last and perhaps least from the point of advisability, we may give the patient various hypnotic substances, of which probably the best for such cases are chloral, trional, and sulphonal. Hyoscine has been recommended for many of these patients, but it probably is limited for its greatest benefits to those who have a tendency to mental delusions in addition to their insomnia.

During convalescence from influenza the patient should be subjected, in those cases where the attack has been very severe, to a complete or modified rest cure, followed by gradually increasing exercise in the fresh air—if possible, at some health-resort. All nervous or mental strain should be avoided and every effort made to conserve the vital energies of the patient until convalescence is ended and perfect health regained. There can be no greater mistake upon the part of such a patient than to make a too rapid return to the ordinary pursuits of daily life, and there is probably no instance in medicine in which the motto *Festina lente* finds a better application than in convalescence from the disease the discussion of which we have just concluded.

(Remarks in regard to Influenza from the standpoint of the rhinologist and laryngologist will be found in Dr. Ingals' article on page 163.)

SCARLET FEVER AND MEASLES.

By H. A. HARE, M. D.

SCARLET FEVER.

The treatment of scarlet fever consists in its prophylaxis, the management of the case during the different stages of the malady and of its complications, and finally, the methods by which its sequelæ are to be combated.

Scarlet fever is, as is well known, one of the most infectious of the exanthemata, and (now that smallpox has been so nearly conquered by vaccination) there is no other of the eruptive fevers which is so much dreaded; for typhoid fever is not infectious except by fomites, and typhus fever is very rarely seen in ordinary practice. The preventive treatment or prophylaxis of scarlatina is therefore of immense importance.

The first measures in the event of an outburst in force in any given district is to close the schools, to forbid large festive gatherings of children, when one infected child often infects a multitude, and the isolation not only of the sick, but also of those who have to the physician's knowledge been exposed to infection. These are the hygienic rules which should govern the general population.

The special rules for the prevention of the spread of the epidemic by the careful management of the sick individual have yet to be considered. In addition to rigid isolation the greatest care should be taken that the child's attendants are not allowed to mingle freely with the rest of the household. One or two capable members of the family, or the trained nurse or nurses, should be set aside solely for the duty of caring for the invalid, and should change their clothes and bathe in a room adjoining that in which the patient lies, and thoroughly disinfect themselves before going out of these rooms. The clothes worn by the attendants should consist of materials which can be boiled and washed as soon as taken off; and these light stuffs carry the contagion far less readily than heavy clothes. All books used by the patient, or his attendants while they are on duty, should be destroyed or carefully disinfected if a suitable disinfecting plant can be obtained. The disinfection of books is, however, all but impossible unless each page and crease is opened. All bed and other clothing used by the sick person or his attendants should be washed

in different water and at a different time from that of the rest of the family, and should not be trailed through the house between the sick-room and the laundry or made into a bundle, but instead should be submerged in a bucket or tub of bichloride of mercury solution or of hot water and so carried out to the clothes-boiler, into which it should be put immediately, the water in the boiler being already at boiling-point. The lid should be put on the boiler at once.

If it is possible to prepare the room before the patient is moved into it, all heavy curtains and hangings should be removed, the carpet taken up and the floor left bare, or, if this is inadvisable, the floor may be covered by matting which can be burned after the child is well. An iron bedstead should be used by preference, as it can be well disinfected. It is hardly necessary to add that the mattress on which the child has lain should be burned, as it cannot be well disinfected by ordinary methods. The discharges of the patient should be received in perfectly clean vessels which are constructed so as to be readily scalded out and disinfected, and a colored solution of bichloride of mercury be placed in them to destroy the contagion as soon as it leaves the body, the color being added to prevent possible poisoning by swallowing the clear bichloride of mercury solution, which may be kept in a bottle or other vessel before it is put in the bed-pan.

In regard to the child itself there is every reason to believe that the anointing of its entire body with olive oil or faintly carbolized vaseline distinctly decreases the danger of infecting other persons, since it prevents the wide dissemination of the branny scales or flakes of skin, which are highly infectious; and this treatment in addition allays the burning of the surface, seems to lower the fever, and so gives the child comfort. Much discussion has arisen as to the real efficacy of this method, some claiming that it is of great benefit in every way and others denying its usefulness. The writer, however, believes that this plan of treatment is of the greatest service and strongly recommends it. After convalescence is well established the anointings of oil should be followed in a few hours by hot baths to wash off both the oil and the dead cuticle. Particular attention should be paid to the head, for the hair often prevents the proper cleansing of the scalp. The child should not mingle with the family till every particle of desquamation has ceased nor as long as there remains any acute discharge from the nose, throat, or ears.

Treatment.

The treatment of scarlet fever requires great care and considerable thought. In no other disease should the physician use his remedies with greater care. He should be a watchman all the time and a therapeutist only when a definite indication is to be met.

From the very beginning of the case, however, particular attention should be directed to the kidneys, and any tendency to diminished urinary flow should be met by the prompt administration of mild diuretic mixtures. In the author's opinion the best results are usually obtained by the use, from the very beginning of the disease, of small doses of a mixture of sweet spirit of nitre, citrate of potassium, and water every four hours. This provides a "treatment" for the child, shows the parents that the physician is not entirely depending upon Nature for aid, and at the same time keeps the kidneys freely acting. In scarlet fever it is much easier to prevent dangerous irritation of the renal epithelium than it is to cure the trouble after it has become well developed. Should the kidneys fail to secrete a fair amount of urine in twenty-four hours under this method of treatment no other directly acting diuretic will prove of much service, but if the circulation is feeble the use of half-grain doses of citrated caffeine or drop doses of tincture of digitalis or a little sugar of milk (5 to 10 grains every four hours) may be resorted to. The caffeine, however, finds its chief usefulness after, rather than during, the acute stage of the malady, and digitalis must always be given in small doses and cautiously to children. By far the better means of relieving kidney congestion and irritation at such or other times is by the use of the hot pack so well described by Baruch in Vol. I. of this SYSTEM. By this pack, if it is used cautiously and rationally, the eruption upon the skin is increased, which is always an advantage, particularly if it already be scanty; the blood is brought to the surface of the body, away from the congested areas, and the effete materials usually gotten rid of by way of the kidneys are to some extent eliminated by the skin.

If the child's temperature is not high we may employ in place of the hot pack a hot-air bath prepared by allowing the hot air from an alcohol lamp to pass under the somewhat elevated bed-clothes of the patient. If the fever is already high the cold sheet followed by the wrapping in the blanket as already referred to is preferable, as it is more soothing to the parched skin and tends to reduce the temperature.

A free allowance of pure water of moderate temperature should always be allowed the patient, and unless the amount taken is so large as to overload the stomach and disturb the appetite it can do no harm, but much good, by freely flushing the kidneys. Nothing can be more cruel or irrational than the old custom of forbidding the free use of water in scarlet fever.

RENAL DISORDERS.—From the very first in all cases of scarlet fever two therapeutic measures, of general utility and designed especially for the purpose of protecting the kidneys from harm, must be resorted to; namely, that the patient be confined to his bed and in a

room having an even temperature day and night, whether the attack be grave or mild, and that as far as possible a milk diet be insisted upon. In these matters too great caution cannot be exercised, first because the renal complications are perhaps the most serious that we meet with, and second because they are often the result of exposure. Again, no more grievous error can be perpetrated than to regard an apparently mild case of scarlet fever as being mild enough to be treated carelessly, for often the full force of the disease seems to be expended on the kidneys, even during very mild attacks.

Again, the fact that there is present merely a febrile albuminuria does not give the physician any right to think that the kidneys are safe from attack; on the other hand, some of the worst cases of scarlatinal nephritis follow attacks in which the albumin has been almost entirely absent from the urine. Should the urine be very concentrated and pain and tenderness be felt over the kidneys mild counter-irritation by a feeble mustard plaster or turpentine stupe may be advisible.

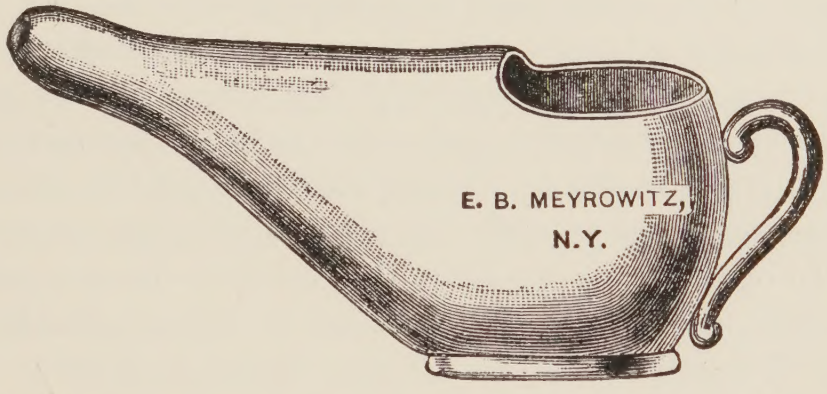
As renal complications are much more frequently causes of alarm to the physician as sequelæ than as initial manifestations of the action of the scarlatinal poison, they will be still further considered later on in this article.

Sore Throat.—One of the earliest and most annoying symptoms which the physician is called upon to treat is the pharyngeal inflammation which is often one of the very earliest manifestations of the disease. At first the condition may be that of the ordinary severe inflammatory sore throat, later if the case is severe or the treatment of the throat is neglected there may be ulceration and the development of a false membrane, and this in turn may be diphtheritic or non-diphtheritic. If the sore throat is severe we frequently have developed much swelling and induration of the tissues under the jaw and in the neck, and the cervical lymph-glands also become greatly swollen. This swollen condition is sometimes called the "collar of brawn." This collar of brawn and its accompanying sore throat is best treated by placing about the patient's throat cloths wrung out in ice-water with sufficient frequency to keep them very cold. Much better than the cloths, however, is the use of an ice-collar formed of a sausage-shaped bag filled with ice. Suppuration in such cases is rare and poultices are never to be employed unless pus is evidently already forming. Should pus form it should be evacuated at once by the knife under the most strict antiseptic precautions. The throat itself should be treated antiseptically and kept constantly cleansed either by the patient using a gargle, or, if he be too young to use a gargle, a spray of Dobell's solution followed by some mild antiseptic such as diluted peroxide of hydrogen or carbolized water (1 : 100).

Often the holding of a small piece of ice in the mouth will relieve the pain of the sore throat, but the difficulty with this treatment is that in the end it increases thirst, and the water from the melting ice may disturb the stomach. Should the condition of the throat become membranous the exudate and the surrounding areas must be treated as if it were the manifestation of acute diphtheria, and for these methods the reader is referred to Dr. Park's article in this volume, or to Dr. Chalmers Cameron's article in Vol. II. of the earlier issue of this SYSTEM.

If the nasal passages are not perfectly free and clean the physician should make them so, for nasal complications in scarlet fever are always serious, and from the nose the middle ear is very apt to become infected by way of the Eustachian tube. If the atomizer cannot be used owing to the struggles of the child the Ideal Nasal Douche of Meyrowitz should be employed. This consists of a glass pitcher of small size and peculiar shape as is shown in the accompanying cut (Fig. 6). The nurse places the child

FIG. 6.



astride of her lap with its back toward the physician, and thus, the physician having covered his knees with a towel or rubber sheet, the head of the child is placed on his lap with its buttocks, back, and limbs resting on the lap of the nurse. By allowing the head of the patient to slip a little between the knees the physician can fix it, and the nurse has good control of the body and limbs, the knees being controlled by the elbows while the hands are held by the nurse's hands. The physician can then use the nasal douche with ease, but a syringe ought never to be employed, since by its use the Eustachian tube may be dilated and infected. After the nares have been well cleansed by this process a gentle spray or vapor of menthol, eucalyptol, and albolene may be driven gently into the nose to soothe the nasal mucous membrane. This formula may be ordered as follows:

℞.	Menthol,	gr. iij (0.15);
	Eucalyptol,	gr. v–x (0.3–0.65);
	Albolene (liquid),	f℥j (30.0).—M.

Or in some cases oil of cinnamon in the proportion of 1 drop may be added to this mixture with advantage.

The difficulty of using any form of nasal treatment in unruly or easily frightened children is great, and in those instances in which the attempt repeatedly produces great struggles and strangling it should not be insisted on unless the presence of false membrane or purulent matter makes the local treatment absolutely necessary, for the exhaustion of the patient does more harm than the local treatment does good.

Fever.—Naturally one of the most constant and often pressing symptoms in scarlatina is the fever, and the question arises as to how much it should be combated by medicinal or other means. This question can be answered in regard to medicines very readily by a negative. The fever of scarlatina ought not to be controlled by drugs, for all the antipyretic drugs have to be eliminated by the already overstrained kidneys, and all of them probably reduce the vital resistance of the system of the patient to the disease. If any antipyretic measures are to be used they must be by means of the use of cold or tepid water in the bath, by sponging, or by the wet sheet. No necessity exists for controlling the fever provided it does not exceed 103° with constancy. If, however, it is in excess of this amount for any number of hours prompt antipyretic measures are advisable. The rule to be followed is that we should use the hydriatric measure which accomplishes our purpose with the least discomfort or shock to the patient. In other words, we order the patient to be sponged off back and front with tepid water, to which may be added a little alcohol for its cooling effect and because it will allay to some extent the fear of the friends that the patient will catch cold. At the time that this sponging is performed the skin should be gently rubbed to keep the blood to the surface. If the use of water at 90° F. fails to reduce the temperature, then we can use it at 85° or even as low as 70°, and if continued sponging for a half-hour fails to materially lower the temperature, then we may resort to the graduated cold bath, or more correctly the graduated tepid bath. The patient is gently laid in a tub containing about 15 inches of water, the temperature of which may be 95° or 90° F. While in the bath he is gently rubbed, and every few moments some of the hot water is removed and in its place is poured in some a little lower in temperature. By this means, if it is done gently and without splash and confusion, the temperature of the bath is gradually lowered, without the production of fright or shock to the patient, and the child's temperature is gradually reduced. Care should be taken that the face and head are bathed with a cooler water than that used in the bath, for if the head is not wet and the body is immersed cerebral congestion naturally results. While certain

practitioners have recommended the pouring of cold water over the patient this process always causes so much shock and fright as to seem to the writer inadvisable and unnecessary. If the fever amounts to hyperpyrexia and becomes a factor of great danger, even the ice-bath may become necessary. The greater the use of cold the more necessary is it to use friction all the time that the patient is in the bath. After the bath the use of a little brandy or whiskey in milk or water may be advisable to bring the blood to the surface if the patient seems cold.

An advantage of the bath aside from the reduction of the fever is the allaying of the itching and burning of the skin and the production of restful sleep or nervous quiet in place of jactitations.

Nervousness and Delirium.—The control of these symptoms is largely obtained by the proper use of the cold baths just described, but in addition we have two other methods of control not yet named, viz. the use of an ice-bag to the head or nape of the neck and the administration of certain nervous sedatives. In the application of the ice-bag the object sought is the gentle abstraction of heat, and for this reason it should be wrapped in a piece of flannel to prevent condensation of moisture on its surface and to prevent local aching from too close applications of cold. The use of the ice-bag is greatly to be preferred to the use of sedative drugs. If it fails, however, then we turn to small doses of the bromides and of chloral with some degree of confidence. The following prescription may be used:

℞. Chloralis, gr. xxiv (1.60);
Sodii bromidi, ʒj (4.0);
Syr. lactucarii (Aubergier), fʒij (60.0);
Aquæ, q. s. ad fʒiij (90.0).—M.
Sig. Dessertspoonful (8.0) every five hours in water if needed (for a child).

In other cases where the only need of such sedatives is at night to produce sleep, a larger dose of bromide of sodium may be used; up to 20 grains if needed by a child of 8 or 10 years.

The itching of the skin and its intense burning, when not relieved by the use of bathing, is best treated by gently anointing the entire body with olive oil or vaseline, either of which may be slightly carbolized (1:100) for the anæsthetic and antiseptic effect of the acid. Curiously enough, such an anointing usually lowers the fever by reducing the peripheral irritation.

Complications and Sequelæ.—We now come to a consideration of the complications and sequelæ of scarlet fever. Their importance is very great, and it is not uncommon, as we have said before, for

a patient to have a mild attack of scarlet fever and a severe attack of nephritis afterward. The worst complications or sequelæ are nephritis and otitis media, which in turn may end in chronic kidney trouble which ultimately destroys life, or in deafness or even in serious and perhaps fatal mastoid disease. Of the prevention of the renal disorder we have already had something to say, so that only its actual treatment when once established remains to be considered. From the beginning of the illness to the end of convalescence a daily measurement of the urine should be made and recorded; and not only should the urine be tested for albumin, but it should be examined microscopically every few days. If it contains only a few narrow hyaline casts, little worry about renal disease need be felt; but if free blood corpuscles and a large number of epithelial casts are present, then the indications of marked renal trouble are present. If in addition the patient has much headache, drowsiness, or vomiting, still further evidences of renal involvement are unfortunately at hand. The bowels should at once be moved by a saline purge, such as magnesium sulphate, preceded, if the case permits, by a dose of calomel, and the free action of the skin may be aided by a hot bath and a hot drink after it. Should the uræmia produce a convulsion the prognosis is of course grave, and the hot bath is our best means of relief. In the bath may be placed a little mustard to increase its stimulating effect on the skin. For the treatment of the nephritis when it has become a well-defined lesion the reader is referred to the article on that subject by N. S. Davis, Jr., in this volume, or that by Dr. Smith in Vol. II.

For very many weeks after an attack of scarlet fever the patient will remain with easily irritated kidneys, and it is well for the physician to keep an eye on his patient for some months, and to examine the urine from time to time, particularly as cold weather approaches. If cold weather produces albuminuria, the patient should be sent to some warm and mild climate where an out-door life without exposure can be followed.

Otitis.—This complication of scarlet fever is often ignored unless its severity enforces attention. If the patient is suffering from delirium and is semi-comatose at the time the otitis is developing, the first intimation the physician may have of the difficulty may be the sudden appearance of a free discharge from the ear. If, however, the pain calls attention to the lesion early in its development, then the physician should resort to the methods described by Dr. S. MacCuen Smith in his article on the Ear in this volume.

Anti-streptococcic Serum.—It is a well-known fact that some of the serious symptoms of scarlet fever arise not solely from the particular micro-organism of the disease, but also from the toxæmia induced by the streptococci found present in large numbers in this affection.

Acting on this fact Marmorek has employed the anti-streptococcic serum, prepared by him, in 96 cases of scarlet fever. Of these 4 died from diphtheria and 1 from pneumonia. In every case the swollen cervical glands and the albuminuria were decreased and no serious symptoms were caused by the injections. In 57 cases of this disease Baginsky has resorted to a similar plan of treatment with great success. Of the 57 cases only 48 were suitable for analysis, and the death-rate in these was 14.6 per cent., the usual mortality in previous years being 22.6 to 34.4 per cent. Further, among 238 cases not treated by the serum the death-rate was 24.9 per cent. The cases which received the serum were less severe than those which had not its beneficent influence.

MEASLES.

THE necessity for treatment of measles is usually in direct proportion to the bad handling of the case from a hygienic point of view, unless the attack be uncommonly severe or the patient be already weak and feeble and so unable to resist disease. In a certain proportion of cases the complications of measles prove dangerous, but in the ordinary attack as we meet with it the symptoms only need guidance to prevent their becoming very severe. The worst cases we are called upon to treat are those which have been exposed to cold during the early or later stages of the malady and as a result have acquired a secondary bronchitis or catarrhal pneumonia.

The treatment of measles itself therefore consists in putting the patient to bed, as a precaution against his exposure to draughts, and in a darkened room in order to avoid any irritation of the eyes by light. The patient being thus protected, his diet should be of the simplest, devoid of sweets and consisting largely of milk, and he should be allowed to drink pure water freely. If any concentration of the urine or scantiness of its secretion ensues, a mixture of sweet spirit of nitre and citrate of potassium with water may be given. If the conjunctivitis becomes excessive or other ocular symptoms develop, the treatment suggested by Dr. Casey A. Wood in this volume may be instituted, while for any bronchial or pulmonary complaint the methods advised in Dr. Herrick's article are advisable.

DISEASES OF THE NASAL CHAMBERS AND ASSOCIATED AFFECTIONS.

By E. FLETCHER INGALS, M. D.

INFLUENZA.[1]

Influenza, also known as grippe and epidemic catarrh, is a catarrhal fever characterized by intense inflammatory symptoms referred to the mucous membrane of the air-passages or digestive tract and great prostration of the nervous system. The disease attacks alike young and old, male and female, of whatever walk in life, excepting infants, who seem to enjoy immunity from it.

Our knowledge of the pathology of the disease does not furnish us with very exact ideas as to its proper treatment. In fact, no lesions peculiar to the disease are found, in the fatal cases death resulting from some complication. The mucous membrane of the alimentary and respiratory tracts usually furnish signs of inflammation, as do also not infrequently the serous coverings of the brain or those of the abdominal or thoracic cavities. Usually at the autopsy the lungs present well-marked evidence of lobular consolidation. From our knowledge of the disease it is evidently dependent upon some transmissible cause, either irritating gas or specific micro-organism.

Its course is marked by three stages: First, the stage of invasion; secondly, the catarrhal stage; and thirdly, the stage of decline and convalescence. The period of invasion is of exceedingly variable duration. Sometimes for twenty-four or forty-eight hours preceding the onset a feeling of general malaise is experienced, this being followed by a chill of greater or less intensity, but the disease may come on suddenly without prodromal symptoms, with distinct rigors or chilly sensations, these alternating with flashes of heat. Headache, pain in the back and limbs, tightness of the chest, and muscular prostration are early symptoms, and are not unlike those of the inception of many acute diseases. The characteristic feature of the period of invasion is intense prostration, out of all proportion with the severity of the other symptoms. Sometimes the symptoms of the first

[1] A consideration of this disease from the standpoint of the general practitioner will be found on p. 143.

stage are absent, and they seldom last more than a single day. The first stage is usually followed by the ordinary symptoms of acute coryza, with sore throat, frequent hacking cough and often dyspnœa, even without apparent involvement of the lung tissue. Paroxysmal sneezing, earache from inflammation of the Eustachian tubes and middle ear, and sometimes epistaxis are observed. Intense frontal headache and sensations of tension and fulness about the vertex, neuralgic pains, and soreness of the muscles are common symptoms.

The nervous system becomes profoundly affected, and in this fact lies one of the principal marks of difference between influenza and ordinary catarrhal fevers. There is a feeling of præcordial distress, muscular tremor, disturbance of the special senses, vertigo, tinnitus aurium, and insomnia. The cutaneous sensibility may be exalted. There may be mild delirium and great despondency. The fever rises rapidly and varies between 100° and 102° F., occasionally reaching 104° and 105°, being very irregular in its course but usually remittent in character. Again, it may be absent or subnormal. The pulse commonly ranges from 90 to 100, and may be much higher.

The inflammation may extend to or below the larynx, involving the trachea and bronchi. Laryngeal irritation causes paroxysms of dry coughing. The tracheitis and bronchitis produce their usual symptoms and add to the discomfort of the patient. The nasal secretion, at first thin and watery, later becomes muco-purulent. The mouth is pasty, the tongue being covered with a thick fur. Food tastes bad, there is excessive thirst, and loss of appetite. Abdominal tenderness followed by diarrhœa, nausea, and vomiting may be observed.

In many cases the course of the disease is marked by the predominance of symptoms pointing to the involvement of special organs. Thus there may be an encephalic form characterized by exaggeration of the nervous phenomena, as intense headache, neuralgia, delirium, and convulsions. Or the disease may be of thoracic form, the severe symptoms being referred to the lungs. Again, it may be abdominal in form, gastro-intestinal inflammation playing the important rôle.

The period of decline and convalescence is exceedingly variable. The disease may subside in two or three days, or may continue as many weeks or longer. As a rule, the older the patient the longer the duration of the disease. The later stages of the disease are usually marked by gradual subsidence of the symptoms, but sometimes the affection terminates abruptly with some critical discharge. Convalescence is usually slow and is frequently attended by persistent cough, loss of appetite, and excessive fatigue after slight exertion. Relapses are very frequent.

Before instituting treatment for the disease it is to be distinguished

from acute, non-specific rhinitis and inflammation of the larynx, trachea, and bronchi, also pharyngitis and tonsillitis. Influenza is not altogether unlike these diseases, but differs greatly in its epidemic nature and in the severity of its symptoms. During epidemics of this disease there is a popular inclination, which unfortunately extends even to physicians, to invest every catarrhal disorder with the name of the current epidemic. In this way acute pharyngitis, or tonsillitis, and even acute catarrhal gastro-enteritis, typhoid fever, and tuberculosis are mistaken for influenza proper. But usually the proper diagnosis can be made by the history of an epidemic, the generalization of the symptoms throughout the mucous membranes of the body, the severe headache, mental depression, and muscular pains. The physician is usually called upon in the course of the case to give an accurate prognosis, and, without proper diagnosis and definite ideas as to the involvement of the different organs, and complications, he is often led to make a grave mistake.

When occurring in the very young or the aged, or in persons greatly debilitated from any cause, or in persons suffering from chronic cardiac, renal, or pulmonary disease, influenza must be regarded as a grave affection. Uncomplicated cases seldom prove serious, but with the complications referred to probably about 3 or 4 per cent. prove fatal. When pregnancy complicates, abortion is likely to follow. The common sequels are rheumatism, functional heart-disease, protracted fevers of a typhoid character, pleurisy, and pulmonary tuberculosis.

Treatment.—We are as yet unable to prevent the disease by any form of treatment, but during an epidemic everyone should be especially careful to avoid exposure; and the enfeebled as well as children should remain in-doors as much as possible. The administration of quinine and nux vomica may have some effect in rendering the system less susceptible to an attack. At the onset of the disease the patient should be put to bed. A laxative dose of castor oil or a seidlitz powder should be administered. Quinine and opium are said to abort the attack. In the course of the disease agreeable drinks and light diet are to be allowed. Bronchial catarrh and cough can be relieved by the usual remedies. Phenacetin and other coal-tar products may be given to relieve the pain, but should not be long continued. The salicylates are probably better for this purpose, and when administered early may shorten the attack. Later, preparations of nux vomica, hyoscyamus, and camphor, together with potassium bromide, in large doses, which has a marked effect on the cough, are recommended. Hot moist inhalations relieve the irritability and inflammation of the mucous membrane of the upper air-passages; oleaginous or weak alkaline sprays relieve the nasal mucous membranes. Complicating

diseases are to be looked for and treated as they appear. During convalescence quinine, iron, strychnine, elixir of calisaya bark, compound tincture of cinchona, and other vegetable bitters are very useful, and are needed for a considerable period of time. If the convalescence is protracted a change of climate may accomplish great good. The patient must avoid exposure to cold until the health is restored.

RHINITIS.

Simple Acute Rhinitis.

Simple acute rhinitis, also known as acute coryza, acute nasal catarrh, acute cold in the head, and acute rhinorrhœa, is an inflammation of the nasal mucous membrane. It is characterized by sneezing, hypersecretion, and more or less obstruction of the nares. It occurs among all classes of society, at all ages, and in all seasons and climates.

Fermi and Bretschneider [1] after careful clinical and bacteriological researches upon cases of acute rhinitis claim, first, that simple coryza is not a germ disease; second, that many coryzas are due to the irritant action upon the nasal mucosa of exciting agents, partly physical and mechanical and partly chemical, attacking the mucosa from the external surface, as trauma, polypi, fumes, etc., or from within, as after the ingestion of iodides; third, that colds so called are due to functional trophic, vasomotor disturbances of the mucosa. They are not due to the action of mere cold as such, but to sudden and severe changes of temperature combined with a high hygromic state or when the body is overheated. According to Fränkel infantile coryza is generally due to direct infection from the vaginal secretions at the time of birth. Other causes are, inhalation of certain gases, hot air and dust; exposure to the rays of the sun, eczema, measles and other fevers, and extension of inflammation from the pharynx, larynx, or conjunctivæ. Checking of chronic discharges, as of otitis and ophthalmia, or bleeding hæmorrhoids, is said to be followed in some cases by acute coryza.

One or both nares may be involved and the inflammation may extend into the accessory sinuses, tear-ducts, and Eustachian tubes. On rhinoscopy the mucous membrane appears red, swollen, and, if early in the disease, dry. In a very short time a profuse serous secretion appears, which later becomes sero-purulent. The nostrils and upper lip may be greatly irritated by the discharge.

The attack may be ushered in with more or less chilliness, headache, malaise, aching of the back and limbs, and slight fever. Sneezing, partial nasal obstruction, and hypersecretion follow. General symptoms may be severe or slight. There is usually mental and

[1] *Archiv. Ital. de Otal.*, 1895, iv.

physical debility and sleeplessness, partially from mouth-breathing and partially from pains and headache. The senses of taste and smell may be obtunded. From extension of the inflammation to the Eustachian tubes there is often earache, a sense of fulness or ringing in the ears, and partial deafness, all of these symptoms being generally relieved by the application of a small amount of a weak solution of cocaine, which reduces the swelling. Exceptionally the cervical lymphatics become enlarged and tender. The voice usually lacks the nasal resonance and articulation is imperfect, the letter *m* being sounded like *b* and *n* like *d*.

The attacks sometimes last but a few hours, but usually last from a few days to a week or two, and are sometimes prolonged several weeks. Repeated attacks usually bring on the chronic form of rhinitis or chronic inflammation of some one or more of the adjacent sinuses or cavities.

Treatment.—It is quite as important to treat patients between attacks as during the inflammatory process. In this way much can be done to prevent subsequent recurrence of the affection. For this purpose daily exercise in the open air, sponge baths over the chest, with cold water or salt and water, cold foot-baths, proper clothing, and avoidance of exposure to all things which have been found to excite the inflammation of the mucous membranes, are to be advised. Early in the disease a hot foot-bath, together with a bowl of hot lemonade before going to bed and 10 gr. of Dover's powder given at the same time, will usually check the pain, produce sweating, and often abort the attack. Quinine in large doses, alcoholic stimulants, and the ammonium salts also have a reputation for aborting the attack.

A brisk cathartic early in the attack, especially when the bowels are confined, is of great service. Sometimes the affection may be aborted by frequent inhalations of chloroform, or of chloroform with 5 to 10 per cent. of menthol, poured out into the palm of the hand ; or the vapor of ammonium carbonate, camphor, iodine, or carbolic acid. But perhaps the most satisfactory abortive treatment is large doses of quinine supplemented by the application to the nares of a small amount of cocaine, either in powder or by spray.

A cold twenty-four hours old can seldom be aborted. It will run its course and must simply be carried through to a speedy favorable termination, giving the patient as much relief as possible.

Totally abstaining from liquids, as recommended by C. J. Williams,[1] is said to cure the attacks, the nasal secretion beginning to dry up in about twelve hours, and ceasing in from twenty-four to thirty-six hours. He allowed but a half-ounce of milk or tea twice a day and an ounce of water at night.

[1] *Cyclopœdia of Practical Medicine*, London, 1883.

If Turkish baths are taken, as they sometimes are with benefit, great care should be taken to avoid subsequent cold.

I have obtained the most satisfactory results by administering at first some form of opium or morphine with a large dose of quinine, this to be followed by the application to the nasal mucous membrane of 1 to 2 per cent. of cocaine in water, oil, or in a powder with sugar of milk and starch. The use of an oily spray four or five times a day protects the surfaces and greatly aids in the treatment. The patient may take three or four times a day small doses of nux vomica, together with camphor monobromated, and cinchonidia salicylate or quinine.

Chronic Rhinitis.

Chronic rhinitis, also called chronic catarrh and chronic coryza, is characterized by dryness of the nasal mucous membrane, excessive secretion from the nostrils, which may either discharge freely or partly collect in crusts. The nares are usually partially obstructed and there is an inclination to clear the throat by hawking and expectorating. The disease is brought about by frequent exposures to the causes of the acute form and occurs in all climates in every season, being less pronounced in summer. Residents near large bodies of water and also those in dry, dusty climates seem to be attacked most frequently, so we cannot well depend on climate alone in the treatment of the disease; but people engaged in out-door work become less susceptible to it.

In order to properly treat any case we must place it in its proper class. We find several varieties of chronic rhinitis. They have been classified as follows: 1. Simple Chronic Rhinitis; 2. Intumescent Rhinitis; 3. Hypertrophic Rhinitis; 4. Atrophic Rhinitis.

Simple Chronic Rhinitis.

Simple chronic rhinitis is a catarrhal inflammation of the nasal mucosa attended by little or no swelling.

The patient usually gives a history of repeated attacks of "cold in the head," and states that for some time past, several months or more, he has suffered with a constant irritation in the nares. These irritations are described as itching, burning, or tickling in character. Sneezing occurs with slight provocation. The eyes often ache, and pain in the frontal region is very common. The senses of taste and smell become less acute and hearing is imperfect. The inflammation may extend through the tear-duct to the conjunctiva and severe lachrymation result. There is usually a profuse watery discharge from the nose occurring upon trifling irritation such as the inhalation of cold air. Later the discharge may become muco-purulent. The

general health of the patient is not usually much impaired by this affection.

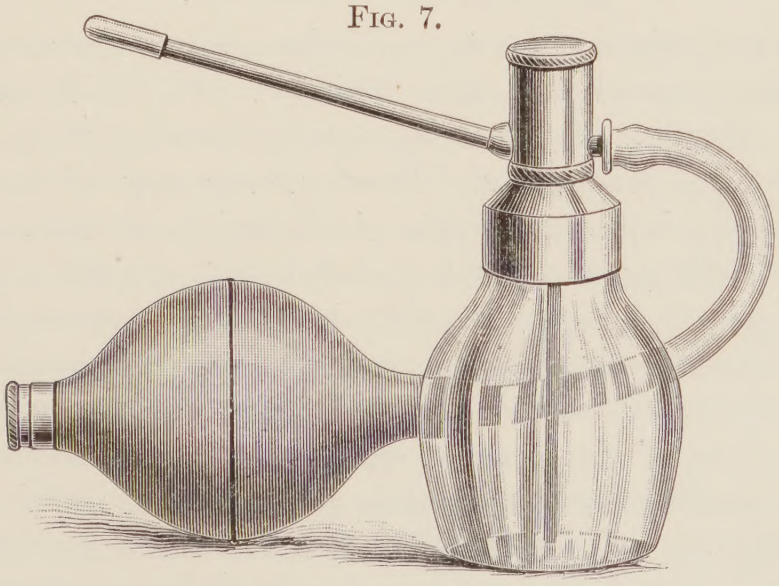
On rhinoscopic examination the mucous membrane is found to be congested, the surface bathed in its own secretion, with more or less mucus collected in the nasal cavity, and at times there may be tenacious masses of partially dried secretion clinging to the walls. The naso-pharynx presents a similar condition of congestion with adhering secretions.

Before deciding upon the treatment the diagnosis between this affection and hay fever must be made. It will be remembered that the latter comes on at stated periods of the year, while rhinitis may appear at any time and is apt to be continuous with occasional exacerbations. Though the use of the probe may detect special sensitive spots, as in hay fever, the atrophic and hypertrophic changes so characteristic in chronic rhinitis are not so apparent in hay fever.

Treatment.—In spite of treatment the disease may be tedious in its course and terminate in some of the other forms of rhinitis. A cure may be sometimes established and much relief is afforded by proper treatment. The irritability of the mucosa can be relieved and the excessive secretion checked, so that even if a permanent cure is not ensured the treatment is very satisfactory.

Watery secretion serves one useful purpose—that of cleansing the nares, so that when this is present washes are unnecessary. In this class of cases soothing astringent powders and sprays are very efficacious. These applications should after a few seconds of discomfort cause a feeling of relief. They should never irritate for more than five minutes. Mild preparations can be used at first, and their strength may

FIG. 7.



Davidson's Oil Atomizer, No. 50.

be gradually increased as the membrane becomes toughened. Some physicians adhere to alkaline solutions, but the oily sprays are doubt-

less of greater utility. Liquid albolene and oleum petrolina are most commonly employed. Melted vaseline has also been put to the same use. The effect of these oils is soothing and palliative. They should be prescribed for the patient to use freely at home two or more times a day. The addition of ten minims of terebene to the ounce of one of the above oils is sometimes effective in checking the discharge. These sprays are best applied by some atomizer that throws a large spray, like the No. 50 Davidson (Fig. 7).

Below is a prescription for a sedative powder which may in some cases be applied once or twice a day, in addition to the spray, with decided benefit:

℞. Iodol, gr. v (0.3);
Amyli, gr. ij (0.12);
Sacchari lactis, q. s. ad gr. c (6.65);
[With or without—
Cocainæ hydrochloratis, gr. i–ij (0.05–0.12)].—M.

The prescription must not, however, be given the patient so that it could be repeated, and it must not be employed continuously.

The sensitive areas can be best relieved by superficial cauterizations with the galvano-cautery, as in hay fever. These operations can be performed as often as once in five or seven days. Sedative powders and sprays should be used between treatments. The terminal fibres of the hypersensitive nerves are thus destroyed, but no scar is left because the mucous membrane is not burned deeply enough.

Intumescent Rhinitis.

Intumescent rhinitis is a form of chronic rhinitis occurring more frequently than any of the other varieties. Its chief feature is the intermittent swelling of the nasal mucosa, causing more or less obstruction to nasal respiration. The swelling may be found on both sides, but usually but one side is obstructed at a time, though this condition may change in a few moments to the opposite naris. Often, when the patient is lying on the side, the undermost cavity is occluded, but, a few moments after turning over, the opposite side stuffs up and the side formerly obstructed becomes free. Inspection will usually detect congestion of the mucous membrane, but it may appear pale. Usually the swelling or tumefaction is confined to the mucous membrane covering the inferior turbinals, but the middle turbinated bodies may also be involved, and even part of the membrane over the septum, especially that part directly opposite the turbinated bodies. It is not unusual to find the cavities temporarily free, though obstruction in one or both nares may have been noticed several times during the

day or night. On the obstructed side more secretion is usually found, because of imperfect evaporation and increased activity of the glands. The pharynx and even the larynx may finally become chronically inflamed, and, if the inflammation extends to the Eustachian tubes, partial deafness results, all of which complications are often relieved by reduction of the nasal swelling.

In this as in other forms of chronic rhinitis we have to assign repeated exposure and acute attacks of rhinitis as the cause. The patient gives a history of great susceptibility to the disease. He complains of the annoyance of mouth-breathing from nasal obstruction, attended by hawking and efforts to clear the throat, particularly in the morning and after eating, and also of dropping of mucus into the throat from the naso-pharynx. There may be little or no increase of nasal discharge. The secretion sometimes collects in the nares, and if it remains for any length of time becomes offensive from decomposition.

Intumescent rhinitis must not be confounded with the hypertrophic form, from which it can be distinguished in uncomplicated cases by the use of a 4 per cent. cocaine powder or spray thrown into the nares. This in two or three minutes reduces the swelling so that the cavities appear of normal size. So also exercise, as running up-stairs, may produce temporary reduction of the swelling. In the intumescent rhinitis the soft tissues may be pressed down with the probe until the bone is felt, the dent thus formed quickly disappearing on removal of the instrument. Nasal mucous polypi are lighter in color; they can be moved; they allow the passage of the probe on either side, and are not reduced in size by the application of cocaine.

Before considering the treatment it must be remembered that intumescent rhinitis, if left to itself, may terminate spontaneously in recovery, but that it usually lasts for months or years and at last eventuates in the hypertrophic form; also that pharyngitis and laryngitis often result from mouth-breathing, and that in many cases throat-deafness is caused by involvement of the Eustachian tubes. The effect of imperfect oxygenation of the blood upon the general health is not to be forgotten, such patients having much less endurance than those with free nasal chambers.

Treatment.—Great importance is attached to the prophylactic treatment of the disease. All persons susceptible to catarrhal troubles should be very careful to avoid exposure to all causes known to produce the affection. They should wear woollen underclothing all the year round, the hot summer months alone being excepted, when silk but not cotton underwear may be substituted. Systematic exercising regularly practised, followed by cold sponging and the vigorous use

of a coarse towel, together with daily bathing the feet in cold water, will be found of great service in preventing colds.

In the early stages of the affection sedative remedies regularly used, together with mild astringents or stimulants occasionally applied to the nose, may establish a rapid cure. The milder stimulating remedies, which may be applied two or three times per week, consist of solutions of zinc sulphate about gr. ij to the ounce, with or without a similar amount of carbolic acid or zinc chloride, gr. ij to gr. v to the ounce of distilled water. Milder solutions should be employed at home two or three times each day, such as boric acid gr. x to the ounce, or sodium bicarbonate and biborate, equal parts, gr. iss to gr. ij to the ounce. When a somewhat more stimulating application is desired a saturated solution of boric acid in camphor-water is excellent. Oily preparations containing camphor gr. $\frac{1}{2}$ to j, menthol gr. ss to j, or thymol gr. $\frac{1}{4}$ to $\frac{1}{3}$, are generally of more benefit than the aqueous solutions. The sedative powders mentioned under Simple Chronic Rhinitis may also be very advantageously employed in addition to this treatment.

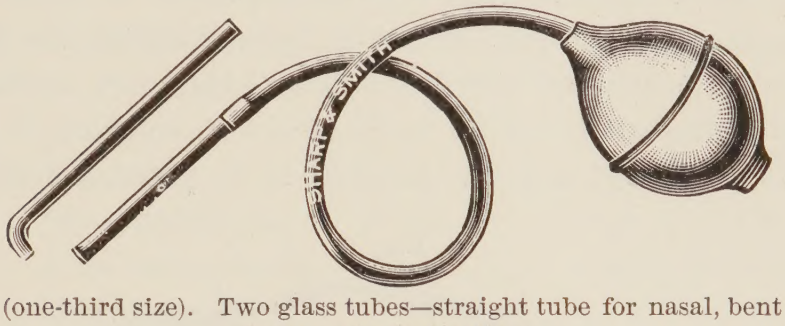
The continuous use of cocaine in however small quantities should be avoided, both on account of the danger of forming the cocaine-habit and because it seems to partially paralyze the vasomotor nerves when used for any length of time and thereby causes turgescence of the cavernous tissue of the mucous membrane and thus aggravates the affection we are endeavoring to relieve. When properly employed, however, this drug is of great advantage in relieving the acute exacerbations of the disease and causing the temporary reduction of the swelling. Cocaine is very conveniently used in powder form. This may be blown into the nares by means of a hand-insufflator, two or three times a day, in doses not to exceed gr. $\frac{1}{30}$. The following formula is recommended:

℞. Sodii bicarbonatis,
Sodii biboratis, āā. gr. iss (0.09);
Amyli, gr. j (0.06);
Cocainæ hydrochloratis, gr. iv (0.25);
Sacch. lact., q. s. ad gr. c (6.65).—M.

This is not to be prescribed, because of the danger that the prescription may be refilled. It is much safer to dispense the powder to the patient so as to be able to know just how much he is using. He may also be supplied with a short glass tube about four millimetres in its internal diameter and eight or nine centimetres in length, flattened and expanded at one end but round at the other, to be used for applying the powder. He is instructed to work a small quantity into the

round end of the tube by moving it about in the powder, and to slip one end of a piece of rubber tubing about twenty-five centimetres in length over the same end of the glass tube; then place the flattened end in the nostril and the free end of the rubber tube between his lips and with a short quick puff blow the powder into the nares. When the physician makes the applications it is much more elegant to use a hand-insufflator (Fig. 8). Any application for frequent use

FIG. 8.



Powder-Blower (one-third size). Two glass tubes—straight tube for nasal, bent tube for naso-pharyngeal, applications.

at home should not cause discomfort for more than three or four minutes, and should be followed by relief to the patient. Stronger applications may be made every two to five days.

Secretions that collect in large quantities in the nasal chambers should be washed away once or twice a day with an alkaline or salicylate solution, as the following:

℞. Sodii salicylatis,
Sodii biboratis, *āā.* ʒvj (24.0);
Sodii bicarbonatis,
Sodii chloridi, *āā.* ʒx (40.0).—M.

Sig. ʒj (4.0) to Oj (500.0) of tepid water.

Or, Rhodes' nasal tablets, the formula for which is—

℞. Potassii chloratis, gr. iiss (0.15);
Sodii bicarbonatis, gr. x (0.65);
Sodii chloridi, C. P., gr. x (0.65);
Sodii salicylatis, gr. v (0.35);
Sodii biboratis, gr. v (0.35);
Thymol, gr. $\frac{1}{8}$ (0.008);
Eucalyptol, ♏ $\frac{1}{4}$ (0.016).—M.

Sig. Dissolve one tablet in glass of warm water and snuff up the nose from palm of hand once or twice daily.

An excellent alkaline solution may be made at almost any home by dissolving an even teaspoonful of sodium bicarbonate in half a pint of lukewarm water, or a similar amount of equal parts of sodium bicarbonate and sodium chloride. The former sometimes causes an uncom-

fortable sensation of dryness not produced by the latter. The nose having been cleansed, the applications already recommended should be made.

These remedies give temporary relief in fully developed cases, but cannot be expected to effect a cure. They are therefore advised only as an aid to more radical treatment. The most efficient treatment consists in the cauterization of the swollen tissue, either by chemical agents or by the galvano-cautery; or in the removal of redundant tissue with the steel-wire snare or scissors.

Various chemical agents have been recommended for this purpose, but strong acetic acid or chromic acid are the most useful, the latter being usually preferred. A 50 to 75 per cent. solution of the chromic acid may be used, but a better method is to place a few crystals of

FIG. 9.

Flat Nasal Probe ($\frac{2}{3}$ size); made of aluminum, and bent at an angle of 35°.

the acid upon an aluminum probe and hold it over an alcohol or other flame so that the crystals fuse slowly and finally dry, but without burning; and then rub the fused crystals, held on the probe, over the part to be cauterized, which soon becomes of a brownish color. Any excess of acid can be neutralized by an alkaline spray, which should always be applied immediately after the use of the acid. One should never use at one time an amount of acid exceeding one-quarter the size of a grain of wheat. It should be applied along a narrow line from ten to twenty millimetres in length.

Bosworth considers touching the membrane at separate points quite as efficient, but I have not been as much pleased with this method as with the one described. A repetition of the cauterization is not advisable until complete healing has occurred, which will require from ten to twenty days. Much more pain is produced by chromic acid than by the galvano-cautery. The wound heals more slowly and gives rise to a more irritating discharge, therefore I much prefer the latter. With the galvano-cautery an electrode is used with a blade about fifteen millimetres in length made of No. 21 platinum wire. A linear incision the whole length of the turbinated body and deep enough to just touch the bone in a few places should be made. If necessary a second and even a third incision should be made a few lines above or below the preceding one, sufficient interval being left between cauterizations to allow healing to take place. Both nares may be treated in the same way if similarly affected, the cauterizations being made in turn on alternate sides.

Whatever method is used for cauterization, the site of the operation should first be anæsthetized with cocaine. For this purpose a 4 per cent. solution should be applied by means of a small cotton pledget on the flat nasal probe referred to above; or by spreading a thin film of cotton saturated in the cocaine solution over the field of operation. Some operators apply the cocaine by spray, but either of the above methods is more accurate; I prefer the first mentioned, as with it there is less absorption of the drug. When applied on the probe the application must be repeated three to five or more times at intervals of one or two minutes apart. I prefer as a local anæsthetic the following solution:

℞. Atropinæ, gr. $\frac{1}{10}$ (0.006);
Strophanthinæ, gr. $\frac{1}{5}$ (0.012);
Olei caryophylli, ♏iij (0.18);
Acidi carbolici, gr. x (0.65);
Cocainæ hydrochloratis, gr. xx (1.35);
Aquæ dest., q. s. ad fl ℥j (30.0).—M.

Usually when the patient cannot feel the application of the probe to the part it is ready for cauterization. It is advisable then to apply an oily spray containing about five minims of oil of cloves to the ounce. This serves the triple purpose of antisepsis, lubrication, and protection. The cauterization can now be performed as above described, after which, to assist in repair, two or three grains of iodol should be blown into the side operated upon. A small pledget of cotton should then be placed in the nostril on the same side and the patient instructed to change this at will, but to wear it for a day or two while out of doors.

Suitable after-treatment following the cauterization, either by acid or galvano-cautery, must be employed. This consists of the use at home of a mild antiseptic spray, as, for example, gr. $\frac{1}{3}$ of thymol, gr. ss of carbolic acid, and ♏iij of oil of cloves to the ounce of liquid albolene, or, if this proves too stimulating so as to cause pain, its strength must be reduced. The patient may also be given a 4 per cent. cocaine powder to be used for a few days only, to keep down the swelling which usually follows the cauterization, and thus avoid adhesions. For this powder I prefer the following formula:

℞. Sodii bicarbonatis, gr. j (0.06);
Sodii boratis, gr. j (0.06);
Magnesii carbonatis, gr. iij (0.18);
Cocainæ hydrochloratis, gr. iv (0.25);
Sacch. lact., q. s. ad gr. c (6.65).—M.

The patient should be directed to return on about the fourth day, when the flat probe should be passed between the site of the operation and the opposite septal wall, so as to further prevent any adhesion of the two surfaces. Cauterization may be made on the opposite side ten or twelve days later.

Coexisting laryngitis and pharyngitis should receive proper treatment at the same time. About four-fifths of the annoyance caused by this disease will disappear very soon after the nasal obstruction has been removed.

In intumescent rhinitis a slight change of climate, especially from a damp to a dry climate, will often give immediate relief, though the affection usually recurs as soon as the patient returns home.

Hypertrophic Rhinitis.

Hypertrophic rhinitis is a chronic affection characterized by hyperplasia of the mucous and submucous tissues of the nares, causing permanent thickening of the turbinated bodies, especially the inferior, and sometimes of the septum, usually at its upper part. The thickened mucous membrane is usually congested, but may be abnormally pale, the former condition calling for sedative or astringent remedies, and the latter for stimulating applications. The hypertrophy is usually limited to the soft tissues, but occasionally the bones themselves are likewise hypertrophied. The condition commonly involves both sides, but it may be limited to one naris. Exostoses, enchondroses, or deflection of the nasal septum are frequently found associated with the hypertrophy. In case of deflection the inferior turbinated body upon the concave side is apt to be much more involved in the hypertrophy than its fellow, which may, indeed, be found atrophied. There is also, in most cases, swelling of the soft parts overlying the hypertrophy, so that the nasal chambers are from one-half to three-fourths closed or completely obstructed, this condition changing from time to time with the change in the amount of swelling.

Hypertrophic rhinitis, in fact, usually results from the intumescent form, being produced by the same conditions that cause the latter variety; hence the importance of relieving all catarrhal symptoms as early as possible. Patients, however, do not usually present themselves for treatment until the hypertrophic condition is well established. They then state that they are very susceptible to colds, and that for a number of months or years there has been stopping up of the nose, especially during the night, and excessive discharge from the nostrils or into the naso-pharynx, with hawking and a constant inclination to clear the throat. Mouth-breathing upon any exertion, as in rapid walking, or when riding a bicycle, or during sleep, is a common symptom. Hearing is usually impaired to some degree; in fact, hyper-

trophic rhinitis is the most common cause of deafness. Frontal or occipital headache is frequently complained of, and also a feeling of pressure over the bridge of the nose, especially when the mucous membrane of the two sides of the nasal cavity is in contact. Temporary relief may be afforded from these symptoms by analgesics and often by local oily sprays, which protect the surface, but this improvement is seldom lasting. Inspection reveals a collection of mucus or muco-pus at the lower part of the cavity, and sometimes dried secretion collected in crusts on the septum or turbinated body. The former of these conditions is best relieved by mild alkaline detergent washes, the latter by the same applications supplemented by oily sprays. The vault of the pharynx appears congested, and often lodges tenacious mucus or dried masses that upon partial decomposition cause an offensive odor.

In order to direct the treatment intelligently it is necessary to distinguish hypertrophic rhinitis from the intumescent variety, syphilitic disease of the nose, and mucous polypi.

In intumescent rhinitis an indentation is easily made with the probe, and swelling rapidly disappears on application of cocaine—signs not found in true hypertrophy.

Syphilitic disease of the nose when unattended by ulceration can only be distinguished from hypertrophic rhinitis by a careful consideration of the history, the presence of other signs, and the effect of specific treatment.

Mucous polypi are distinguished from hypertrophy of the anterior or posterior ends of the turbinated bodies by careful inspection and palpation with a probe. Polypi are more movable, and the probe can be freely passed between them and the external wall, which is not the case in hypertrophy of the turbinals. The polypus is more translucent and its surface is smoother than that of the hypertrophied tissue.

The disease, unless properly treated, may extend over a number of years. It may terminate by atrophy in less than two years, but it is usually of long duration. The usual course is a gradual increase in the hypertrophy until the nares are much obstructed; then the disease remains stationary for a variable length of time, when at last atrophy sets in and progresses until the nares are much enlarged, though obstructed by collections of mucus that become extremely offensive. Occasionally the atrophy continues until the nasal cavities become free, and then terminates spontaneously in recovery. There is no evidence that it ever terminates in tuberculosis.

Treatment.—Until within the last ten or twelve years little or nothing of benefit was done for the hypertrophic rhinitis. Many remedies for internal and topical use have been recommended to cure

the disease, but none of them are of much value, excepting when used in connection with proper surgical interference.

In order to effect a cure it is usually necessary to remove some portion of the redundant tissue. For this purpose we have several measures at our disposal. Chemical caustics, the galvano-cautery, trephines, burrs, saws, scissors, the cold-wire snare, and the galvano-cautery snare, are all in use. Bipolar electrolysis also is credited with good results.

Among the chemical agents that have been used for this purpose are nitric and sulphuric acids, London paste, solutions of mercury nitrate, glacial acetic acid, and chromic acid. All of these caustics, excepting chromic and acetic acids, have deservedly passed into disuse.

Chromic acid is very efficient, but it is open to the objection mentioned under Intumescent Rhinitis. The monochloracetic acid is particularly useful in cases where subsequent adhesions are feared. Carbolic acid, also, injected beneath the mucous membrane, appears to have been successful in some instances. W. Scheppegrell of New Orleans[1] draws the following conclusions from his experience with over one hundred cases treated by bipolar electrolyzation: That compared with other methods it is more conservative, that it effects the destruction of the tissues without destroying the mucous membrane and its glandular elements, and that it has not the disagreeable after-pain following the application of chromic acid. Being a submucous operation, the reaction following it is very slight. He has never seen a synechia formed in the nares due to the effect of electrolyzation. As the operation is not performed as rapidly and with as few sittings as by means of galvano-cauterization, it is not so practicable in cases of young children or very nervous patients. The physical conformity of some nostrils renders it difficult to properly insert the electrolytic needles, and in these cases some other method must be adopted.

The majority of cases may be successfully treated by cauterization, as already described under the Treatment of Intumescent Rhinitis. In this form of the disease more cauterization may be necessary on either side, and very often the middle turbinated is involved so as to require like treatment. In cauterizing the middle turbinals, instead of linear cauterization a small loop-like or pointed electrode may be inserted in three or four places along the lower margin of the hypertrophied tissue.

If the hypertrophied tissue is sufficiently large to render the use of the snare or scissors practicable, one of these instruments, preferably the former, should be used to remove the redundant tissue. But often after the application of the cocaine the swelling is greatly re-

[1] *La Revue Internationale de Laryngologie*, 1896.

duced, and the snare does not then take hold of the tissue. Some patients will endure the pain of the operation without the aid of the cocaine, and then the use of the snare is quite practicable.

Whatever method of operation is used, as pointed out in Ingals' *Diseases of the Chest, Throat, and Nasal Cavities*, it should be the effort of the physician *to save as much mucous membrane as would normally cover the parts*, and to form as little cicatricial tissue as possible.

The hypertrophy may be complicated by bony or cartilaginous enlargement to such an extent that removal of the redundant soft tissues alone cannot suffice to make the nares free. In such cases the bony or cartilaginous growth may be removed by knife, saw, scissors, dental burr, or nasal trephine, as directed under their respective headings.

Submucous infiltratian of the sides of the vomer is common in chronic rhinitis. It causes some obstruction to nasal respiration, also increased secretion and constant dropping into the throat. Rhinoscopic examination reveals a yellowish-white or gray puffiness on one or both sides of the vomer near its posterior margin.

Treatment.—The œdematous tissue should be destroyed by cauterization, the galvano-cautery being preferred; or it may be removed by cutting forceps.

Atrophic Rhinitis.

This may be considered the fourth stage of chronic rhinitis. It is characterized by the large size of the nasal cavities and the collection of drying secretions, which give rise sometimes to an extremely offensive odor. The disease is found among all classes and in all countries, but is usually observed in children and young adults. The cause of the disease is not well understood, but in many cases it appears to be the result of previous hypertrophy. W. A. Martin of San Francisco[1] thinks that all the symptoms and histological changes point to a lesion of the trophic nerves, causing a retardation or an arrest of development.

Usually both nasal cavities, rarely but one, are widened and enlarged to two or three times their normal size. According to More of Winterthur,[2] it is coincident with hypertrophic rhinitis in about 25 per cent. of the cases. In the remainder of the cases the turbinals are often of normal size, but in many cases they are smaller than normal, and in advanced cases may have entirely disappeared.

Because of the large size of the cavities and the tenacity of the altered secretion the patient is unable to expel it. Therefore it dries and forms crusts, which undergo decomposition and may completely

[1] *Occidental Med. Times*, 1895. [2] *Archives of Otology*, New York, 1894.

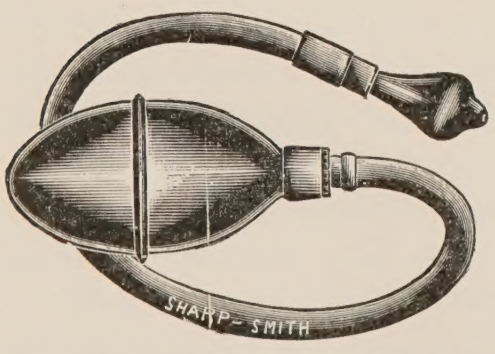
obstruct the cavities. These crusts after a few days are separated by the secretion beneath them, and may be expelled, only later to be replaced by a like mass. The odor from these collections is one of the most unpleasant symptoms of the disease, and can only be relieved by thorough washing. The mucous membrane is usually anæmic, which condition will suggest the use of stimulating applications.

The patient's general health is not usually impaired until late in the disease. The expression of the face is usually dull, perhaps on account of the broadening of the nose, thickening of the alæ, and prominence of the lips usually seen in the disease. The patient often becomes partially deaf, and the sense of smell is usually lost. The secretion is not very abundant, but tenacious and muco-purulent, and at times renders the breath extremely offensive.

The disease may be mistaken for syphilis, lupus, suppuration of the accessory sinuses, foreign bodies in the nose, each of which demands different modes of treatment. The crusts and scabs formed in lupus are usually closely adherent to the septum instead of the turbinals. When removed they leave an ulcerated, bleeding surface marked here and there by the typical tubercle. In syphilitic affections of the nose, after cleansing the part, denuded or dead bone or perforation of the septum or hard palate is apt to be found. Falling in of the bridge of the nose, which often occurs in this disease, is not present in simple atrophy. Suppuration of the accessory sinuses is usually unilateral, the nares are not enlarged, and the sense of smell is seldom lost. Rhinoliths and foreign bodies can be detected by careful inspection and palpation with the probe after the parts have been cleansed.

Atrophic rhinitis may continue for many years if left to itself, but even with the most indifferent care the majority of patients get well before reaching the age of thirty-seven. Under proper treatment a cure can be established usually in from ten to thirty months. The offensive odor can in most instances be relieved in a few days, not to reappear if perfect cleanliness is observed. The anosmia, however, resists treatment, as does also the deafness associated with the disease. At least partial regeneration of the tissues takes place in some cases.

Fig. 10.



Ingals' Nasal Syringe (one-third size).

Treatment.—*Cleanliness* is of the greatest importance in the treatment of atrophic rhinitis, and this part is to be carried out principally by the patient. He should be directed to wash the nares thoroughly from two to four times a day, using from

one to three tea-cups of fluid each time. It may suffice to snuff fluid through the nares from the palm of the hand, and this is the safest method; but if this does not clean the nares thoroughly, some form of nasal syringe (Fig. 10) or douche may be necessary; but with either of these instruments there is danger of causing deafness by forcing fluids through the Eustachian tubes into the middle ear. The syringe appears safer than the douche. While using either of these, little force should be employed; the patient should keep his mouth open and avoid swallowing. Some patients cleanse the nose with water alone, but usually it is better to use some saline solution, either sodium chloride or bicarbonate, or a mixture of the two in the proportion of a heaping teaspoonful to a pint of lukewarm water. Rhodes' tablets, four of which should be used to a pint of water, make an excellent astringent and antiseptic wash. The formula is—

℞. Potassii chloratis,	gr. iiss (0.14);
Sodii bicarbonatis,	gr. x (0.65);
Sodii chloridi,	gr. x (0.65);
Sodii salicylatis,	gr. v (0.34);
Sodii biboratis,	gr. v (0.34);
Thymol,	gr. $\frac{1}{3}$ (0.02);
Eucalyptol,	♏ $\frac{1}{4}$ (0.016).—M.

Listerine, phenol, or other antiseptics in small quantities may be added to the saline wash if desired. After cleansing the cavities, stimulating and antiseptic powders, preceded or followed by an oily spray, have proved beneficial in my hands. Iodol alone or combined with one-tenth to one-fifth of 1 per cent. of mercury bichloride, or boric acid 10 per cent., and cocaine 2 to 3 per cent., answers a good purpose, but the most satisfactory powder I have ever employed consists of—

Yellow oxide of mercury,	$\frac{1}{4}$ per cent.;
Iodol,	25 "
Cocaine,	2 "
Sugar of milk,	73 "

Of this one or two grains should be blown into each naris two or three times a day.

The sensitiveness of the nares will vary much in different cases, and the quantity of the mercurial will have to be increased or diminished accordingly. The powder should not cause much pain, and this should not last more than five minutes at most.

Very useful sprays are composed of liquid albolene with carbolic

acid ♏ ij and menthol gr. ss, or with thymol gr. ⅓ and olei caryophylli ♏ iij to the ounce.

T. Passmore Berens[1] obtained encouraging results from the use of ichthyol in the treatment of a number of cases of fœtid atrophic rhinitis. In severe cases he applies a large cotton tampon saturated with undiluted ichthyol, inserted into each nostril and allowed to remain fifteen minutes. The patient then finds it easy to expel most of the scabs, which latter become loosened by the copious secretion produced. All sinuosities, especially the spaces between the turbinated bodies and the outer wall of the nose, are then cleansed with cotton saturated with ichthyol, using considerable force in rubbing, thus massaging the mucous membrane with pure ichthyol. In less severe cases or where the scabbing is slight the tampon is not used.

Zinc stearate, with 25 per cent. europhen as a stimulant,[2] applied with an insufflator after cleansing, has been used with some success.

Constitutional treatment with quinine, iron, strychnine, arsenous acid in some form, and iodine is of great assistance in many cases. The iodine in sufficiently large doses to cause an increase in nasal secretion frequently gives excellent results.

OZÆNA.

Ozæna is a form of atrophic rhinitis characterized by an intolerable odor of the nasal secretion. The ultimate cause of the disease has not been settled. It is supposed, however, to be of microbic origin, the germ resembling the pneumococcus of Friedländer. Capart of Brussels[3] insists that it is contagious, but this is extremely doubtful. He claims to have often had the husband consult him some years after marriage for ozæna contracted from his wife, and that often a mother suffering from ozæna communicates the affection to her children by allowing them to use her handkerchief. Heredity seems to play an important part in the causation, and there can be but little doubt that it is generally preceded by hypertrophic rhinitis. It also appears, sometimes at least, to be the outcome of a distant inherited syphilitic taint.

The mucous membrane of the nose is deficient in secreting glands and thin, tender, and often ulcerated at some point. The nasal cavities are larger than normal, and the surface is more or less covered with dry decomposing crusts which can only be removed by the most careful washing. The treatment is essentially the same as that for ordinary rhinitis, though it must be more assiduously employed.

Muschold[4] specially recommends a spray consisting of pure glyce-

[1] *American Medico-Surgical Bulletin*, July, 1895.

[2] Gibbs of Philadelphia: *Medical News*, December, 1894.

[3] *Journal de Médecine, de Chirurgie, et de Pharmacologie*, July, 1895.

[4] *Review Internat. de Médecine et de Chirurgie*, Paris, April, 1895.

rin 7 parts, sodium borate 20 parts, and water 30 parts. The glycerin prevents the formation of crusts by causing an abundant watery secretion, and the sodium borate prevents the decomposition of the exudate. The cavities are then to be cleansed by an applicator armed with cotton, and the spraying repeated so as to reach the entire nasal cavities. The patient should use the atomizer three times a day. Under these applications the odor is said to vanish in a few days.

Mackenzie of Edinburgh [1] claims to have successfully treated many cases of ozæna by curetting away the diseased membrane, which he says was replaced by healthy mucous membrane.

RHINITIS MEMBRANOSA.

Rhinitis fibrinosa is an inflammation of the nasal mucous membrane characterized by the formation of a membranous exudate, producing nasal obstruction and giving rise to the symptoms of acute rhinitis, with some constitutional depression. It is claimed by some to be *nasal diphtheria*, as the Klebs-Löffler bacillus has been found in most cases submitted to bacteriological examination. However, its course is much more protracted than that of diphtheria.

Felsenthal [2] considers that, while in the majority of cases rhinitis fibrinosa consists of a form of diphtheria, it has been shown that even in undoubted cases of true diphtheria the bacilli have not a constant virulence. Nevertheless, he insists that in the present state of our knowledge a case in which the diphtheria bacillus is found should invariably be isolated. The disease generally lasts for four or five weeks, and sometimes for several months. No case has terminated fatally. Mild detergent washes or sprays should be freely employed, and non-irritating powders containing about 25 per cent. of iodol, with from 25 to 50 per cent. of trypsin, papain, or other digestive agent mixed with sugar of milk, should be applied three or four times a day.

HAY FEVER.

Hay fever, known as hay asthma, rose cold, June cold, autumnal catarrh, rhinitis hyperæsthetica, and catarrhus æstivus, is one of the neuroses occurring periodically at particular seasons. It is characterized by irritation of the mucous membrane of the eyes, nose, and air-passages, accompanied by excessive secretion and usually by asthmatic attacks.

In America the disease prevails from about the middle of August until the latter part of September, or until early frosts. Isolated

[1] *British Medical Journal*, April, 1895.

[2] *Münchener medicinische Wochenschrift*, Jan., 1895.

cases may, however, occur at any time during the year. Quite a number of cases are observed in May, June, and July, and occasionally instances occur in midwinter. June and July are the favorite months for the disease in England. Men seem to be attacked more frequently than women. It occurs most usually between the ages of fifteen and thirty-five, but no age is exempt. It seldom attacks the laboring classes, but, on the contrary, those of education and culture, and residents of towns and cities rather than inhabitants of the open country.

The nasal mucous membrane is usually highly congested and swollen. The conjunctivæ are also involved in the inflammatory process, and often also the frontal sinus and respiratory tract.

Hay fever is due to a peculiar irritability of the nervous system, supplemented by localized abnormal sensibility either of the whole or a part of the respiratory mucous membrane. There are three important factors in the etiology of the disease: First, nervous temperament; second, abnormal sensibility of the respiratory mucous membrane; and third, certain irritating substances suspended in the atmosphere. The irritants are of great variety, some affecting certain individuals and others exciting the attack in a different class of sufferers when the other factors are present. Our therapeutic measures will therefore be directed to removing as many as possible of these factors.

Heredity and nervous temperament undoubtedly predispose to the affection, for it is often observed in several members of the same family.

As first pointed out by Wm. H. Daly of Pittsburg, an undoubted relation exists between hay fever and certain pathological conditions of the nasal passages that may often be removed by appropriate treatment. Odor of roses and other fragrant plants are to be given an important place among the irritating elements which commonly excite an attack of hay fever. Other excitants are the pollen of Ambrosia artemisiæ folia, known also as Roman wormwood, rag-weed or hog-weed, or that of *Solidago odora*, known commonly as golden-rod; also dust and smoke, especially that of the railway; the pollen of certain grasses, as wheat, rye, oats, barley, or even Indian corn; also the dust of ipecac, salicylic acid, benzoic acid, and lycopodium. Excessive heat or bright sunshine will excite the attack in some individuals. Even imagined exposure to influences which have formerly excited an attack have been known to cause a return of the paroxysm, for example, proximity of an artificial flower or even the sight of a painting of a full-blown rose. These facts indicate a condition very like hysteria in some of the subjects of the disease, and in these particular cases would be a partial guide to therapeutics.

Though due importance must be ascribed to the neurotic element of the disease, and as well to external irritants, the local condition of the nasal mucous membrane must not be overlooked. There exists

in most, if not all, cases a hyperexcitability of the nasal lining that must be allayed to cure the disease. The attacks often return on exactly the same date of succeeding years, regardless of the temperature or other surroundings. But in many persons there is a variation of a few days, apparently dependent upon atmospheric conditions or the advance or delay of the season, so that when the summer is unusually early prophylactic measures should be adopted a week or ten days earlier than in other years.

There are two well-marked types of the disease—the *catarrhal* and the *asthmatic*—that demand different modes of treatment. The catarrhal form usually comes on with a sudden irritation of the mucous membrane of the fauces, conjunctivæ, and nares, accompanied by frequent sneezing. In the latter type asthmatic symptoms may develop very early, but usually not until after the nasal symptoms have existed two or three weeks. Often the nasal symptoms disappear, not to return again for the season, as soon as the asthma is developed.

The asthma in this affection is likely to occur during the daytime, instead of at night, and is usually worse on damp, hot days. The asthmatic type of the disease seldom develops until the patient has suffered from the catarrhal variety for from three to ten seasons.

The attack of hay fever generally begins with a tickling or stinging sensation in the Schneiderian membrane. This is accompanied by violent sneezing and itching of the conjunctivæ, with profuse lachrymation, or by burning or stinging sensations in the throat. In some persons the prominent early symptoms are severe neuralgic pains in the eyeballs or back of the head. Swelling of the eyelids, conjunctivæ, lips, or tip of the nose is frequently present, and may be the first indication of the attack. There may also be constitutional symptoms, such as elevation of the temperature, much prostration, and aching of the muscles. The fever calls for the administration of antipyretics, especially the salicylates, but when there is much prostration the valerianate of quinine is preferable.

The nasal mucosa is usually so swollen as to greatly obstruct the nares, and thus interfere with nasal respiration. In some cases this seems to be the immediate cause of the asthmatic attacks. Profuse watery, irritating discharge from the nose is nearly always present, and may sometimes be promptly relieved by atropine or similar remedies, though these remedies themselves cause even more discomfort than the disease. The discharge subsequently becomes mucopurulent and less irritating.

Hay fever is to be distinguished from simple acute rhinitis and spasmodic asthma. The history of previous attacks at the same season, the abrupt commencement, the excessive irritation, and the

occurrence of asthmatic paroxysms during the day constitute the essential points of difference. Hay fever occurring in young children and for the first time in adults may be very hard to diagnose, but the detection of exquisitely sensitive areas of the nasal mucous membrane by lightly touching it with a probe may serve to clear up the diagnosis.

The attacks vary daily in severity and usually continue from four to six or eight weeks, and may leave the patient in a debilitated condition for several months. After disappearance of the catarrhal symptoms the asthmatic attack may continue for a few hours or days and disappear suddenly, or they may last with incomplete intermissions until early winter. Most persons may escape the attacks by early change of climate, but the disease is apt to recur on return to the same locality during the hay-fever season. Some patients become less susceptible to the disease as they grow older. The affection, *per se*, is not dangerous to life, but the depression it causes may favor the development of serious disease.

Treatment.

As just stated, most patients may escape the hay fever attacks by a suitable change of climate. Even a change from the country to the city or *vice versâ* is sufficient with certain individuals. For most persons, however, the greatest relief is afforded in cool localities, such as are found along the Northern lakes, near the seashore, or at high altitudes where the land is not cultivated. Lake or ocean voyages will relieve some promptly, but the symptoms are very often aggravated by exposure to the wind and bright sunshine on the inland lakes. In America the most popular resorts for hay-fever patients are in the White Mountains of New Hampshire and in the region about Mackinac or Petoskey, Michigan. In fact, any place in the northern part of Michigan or Wisconsin where there is no cultivation would be a suitable place in which to live while the disease is prevalent. After the harvest the stubble-fields become covered with ragweed, which is apparently the most obnoxious of all the exciting causes, and as soon as any locality becomes much settled it is likely no longer to afford immunity from the disease.

No locality will be found suitable for all individuals alike, as some are affected more than others by the various exciting causes. As most of the patients are of a neurotic temperament, nerve-tonics are indicated, and it is better to begin their administration a month before the attack is expected, and to continue them until convalescence is established. Abercrombie[1] claims to have prevented the attacks for two successive years in one neurotic case by the administration of 3 grains of valerianate of zinc three times a day after eating. The various

[1] *British Medical Journal*, 1896.

preparations of quinine, strychnine, or arsenous acid, and asafœtida or some of the preparations of valerian, are most serviceable in warding off the attacks and in mitigating the nervous symptoms in those who are affected.

During the attack opium and belladonna, though either may give the patient great discomfort, are nevertheless often of great benefit. Atropine or hyoscyamus in small doses is especially beneficial in checking the profuse secretion and the tendency to sneeze. The local effects of inhalations of iodine, chloroform, or alcohol are occasionally very satisfactory. Weak solutions of lead acetate are recommended by Mackenzie for relieving the itching of the conjunctivæ. A solution of sodium biborate, grains 5 to 10, or of boric acid, grains 10, to the ounce of camphor-water, is most beneficial for this purpose. This can be used as often as desired for bathing the eyes. The lips and nostrils may be protected from the irritating effect of the secretion by applying the ointment of zinc oxide.

The nasal mucous membrane may be protected from severe irritation in some cases by wool plugs inserted in the nostrils to exclude the irritating substances. A spray of a saturated solution of boric acid will sometimes be found very grateful to the nasal mucous membrane. In some instances boric acid in camphor-water is better; in others the addition of small quantities of atropine, morphine, or cocaine may be necessary before much relief is experienced. In still other cases oily sprays are found more beneficial. A preparation containing about $\frac{1}{3}$ grain of thymol and about 3 minims of oil of cloves to the ounce of liquid albolene is most excellent. In some cases a small amount of the alkaloid of cocaine—not more than one-half of 1 per cent.—may be added with advantage. For general application a powder containing 3 or 4 per cent. of cocaine will be found more convenient. Care must be taken not to administer more than one-third of a grain of this drug a day, and even this dose should not be long continued. Patients are inclined to use the drug to excess, and on this account physicians should never give written prescriptions that may be refilled, and they should know exactly how much the patient is using.

When there are localized sensitive patches or areas in the nasal mucous membrane, the disease may be cured by judicious operative measures. These include the removal of nasal polypi or any spur from the septum that impinges upon the outer wall, linear cauterization along any hypertrophied or tumefied turbinated bodies, and, most important of all, the superficial cauterization of all places found to be extremely sensitive.

The superficial cauterization should be done with a flat electrode guarded on one side, so as to prevent burning the opposite wall, and

should simply sear the mucous membrane of an area not more than ten or fifteen millimetres in diameter. It should be done so as not to destroy the mucous membrane and leave cicatricial tissue. The cauterized part should be outlined on a diagram of the sensitive areas previously made. After four or five days a similar cauterization should be made over some other part of the sensitive area, preferably in the opposite naris. These operations should be repeated from time to time until the sensitive areas are completely covered and no part remains peculiarly sensitive to the probe.

After the cauterizations, as in the treatment of hypertrophic rhinitis, the patient may use a powder containing 3 or 4 per cent. of cocaine four or five times a day for a few days, and also an oily spray similar to that recommended above.

It may be necessary to perform from fifteen to thirty cauterizations in order to cover all of the diseased surface, and the following year a few spots may be found still sensitive, and these must be treated in a like manner. This treatment is not advised during the course of the hay fever, but is best carried out a few months preceding the attack.

From 40 to 50 per cent. of the cases thus treated are cured, about 25 per cent. are greatly benefited, and the remainder are sufficiently relieved of the nasal symptoms to well repay them for their discomfort during treatment.

Chromic acid, carbolic acid, and other caustics have also been recommended for cauterization of the surfaces, but they are much less satisfactory in their results than the galvano-cautery.

A change of climate during the season is to be made if possible, especially in cases of children, in whom there is reason to believe that the disease may be cured.

EPISTAXIS.

EPISTAXIS consists of hæmorrhage from the nose, and has its origin either in the nasal cavities or the adjacent sinuses. The nasal mucous membrane may be swollen or congested or may present a normal appearance, but generally erosion, ulceration, or a small bleeding point may be found upon the cartilaginous septum. In some cases the mucous membrane is thin, and the blood-vessels, being very near the surface, easily rupture upon engorgement from whatever cause.

The bleeding may come from the turbinated bodies, from the posterior nares, from the adjacent sinuses, or from the fragile surface of fibrous or malignant tumors. From these various conditions it will be seen that it is important to thoroughly understand each case before we attempt radical treatment. These bleedings are most frequent about the age of puberty, and are more common in early child-

hood or advanced age than in the prime of life. Occurring in advanced life, epistaxis is often a serious affection that may easily terminate fatally unless proper treatment is adopted.

As a prophylactic measure, the common local causes should be avoided. These are injury from picking the nose, violent sneezing, coughing, straining, and the inhalation of irritants. Polypi or other foreign bodies in the nasal passages may also cause hæmorrhage.

The constitutional causes demand judicious therapeutics. They are such as cause changes in the blood as illustrated in anæmia, plethora, eruptive and relapsing fevers, diphtheria, scurvy, purpura, and hæmophilia, or changes in the vessel-wall found in phosphorus-poisoning, acute yellow atrophy of the liver, Bright's disease, rheumatism, gout, and at times syphilis or chronic alcoholism.

Sometimes epistaxis has been known to take the place of menstruation or of habitual hæmorrhoidal bleeding.

In the plethoric and in fever patients flushing of the face or a sense of fulness of the head and buzzing in the ears may indicate the congestion that may precede the hæmorrhage; and these symptoms in the aged or in others with weak arteries would cause us to refrain from active interference unless the bleeding became profuse or frequently recurrent. The bleeding usually begins without apparent cause, frequently even while the patient is asleep. It commonly flows from one nostril in drops, which follow each other in rapid succession. As a rule, not more than a drachm of blood is lost, though the amount may seem much greater to the patient. In others the blood flows in a stream, and sometimes it is so copious as to prove fatal. Generally, when a large amount of blood is lost syncope results, and then the bleeding is liable to cease.

Most cases terminate spontaneously within five to fifteen minutes; therefore we must be careful not to ascribe too much virtue to the method first employed for stopping the flow. But in some instances the bleeding continues for several hours or days.

Epistaxis in children from no apparent cause, and that from injuries, is seldom if ever dangerous. Occurring in old people without injury or inflammation, it indicates a degeneration of the vessels and may prove serious. In subjects of hæmophilia bleeding is liable at some time to terminate fatally. Profound anæmia may result from oft-repeated and prolonged nasal hemorrhage. In malaria and plethora the bleeding may be beneficial, and in old people epistaxis often saves the patient from a stroke of apoplexy.

Treatment.—In most cases treatment is not necessary. When the bleeding is of a vicarious nature, in plethora, and in old people with atheromatous arteries it should not be checked unless it continues so long as to cause danger from anæmia.

When it becomes desirable to check the hæmorrhage we direct the patient to sit with the head erect, remembering that gravity plays its part here as elsewhere. The mere changing from the recumbent to the sitting posture, or holding the head erect instead of leaning over a wash-bowl, is frequently sufficient to arrest the flow of blood.

The bleeding in mild cases may be readily checked by cold applications to the back of the neck or directly to the nose, or by irrigation of the bleeding naris with hot water at a temperature of 120° to 125° F. As the bleeding is usually from a small point on the cartilaginous septum, continuous compression of the alæ nasi or of the septum for ten or fifteen minutes will often check it. Compression of the facial artery is also recommended, the artery, in certain cases, furnishing the blood-supply to the bleeding part.

In continued or severe bleeding other methods must be adopted. The insufflation of powdered matico-leaves or small quantities of tannin, or spraying with solutions of alum, 30 grains to the ounce; or tannin, 10 grains, or perchloride of iron, 20 minims to the ounce, will be found efficient in some cases. For continued hidden hæmorrhage hydrogen peroxide or hydrozone has been recommended. A drachm or more, being injected into the bleeding nares, is said to give almost immediate relief. It may also be applied on a loose plug of absorbent cotton. Maizonda [1] in a severe case of epistaxis, the ordinary remedies being unsuccessful, tried refrigeration by spraying ether into the nares, with the result of checking the bleeding.

Simple plugging of the nostril with cotton or lint and holding the head forward until coagulation has taken place is often sufficient. When the above measures fail it is necessary to plug the posterior naris, or, better still, fill the whole naris with a styptic antiseptic gauze tampon.

MacNamara in the epistaxis of purpura recommends a wine-glassful of spirits of turpentine in a tumbler of brandy- or whiskey-punch.

In epistaxis from other causes internal remedies may be given, together with the local treatment. For this purpose ergot, opium, and lead acetate are useful. To prevent recurrence the patient must avoid picking the nose, use warm douches and oils, and apply nitrate of silver, gr. x–xl to the ounce, to the ulcer or abrasion; or, better still, with the galvano-cautery, the point of which should be heated to a cherry-red, touch the bleeding point until the surface is thoroughly seared.

NASAL MUCOUS POLYPI.

Nasal mucous polypi are myxomatous tumors which grow from some part of the nasal mucosa, producing obstruction of the passages

[1] *Le Bulletin Médical*, Paris.

and excessive mucous discharge. They usually spring from the middle meatus or the external surface of the middle turbinated, though in a considerable number of cases they grow from the superior turbinated and superior meatus or from the ethmoidal cells. They occasionally take their origin in the antrum or frontal sinus, and very rarely start from the septum. Under the microscope these tumors appear like very œdematous connective tissue. They are composed in great part of myxomatous tissue, and are covered by mucous membrane. Polypi also contain blood-vessels and nerve-fibres. They are commonly pedunculated, but usually sessile. From these features it will be seen that they can be but little affected by local applications short of destructive agents.

Wokes holds that mucous polypi are caused by necrosing ethmoiditis, and Grünwald that they are secondary to empyema of the accessory cavities of the nose.[1] There seems, however, to be no sufficient pathological evidence in favor of either of these theories; nevertheless, in many cases, a continuous discharge of pus from the maxillary or other sinuses, or other discharges, as in ozæna or chronic rhinitis, seem to cause the disease. Polypi often grow without any appreciable provoking cause and with all the appearance of spontaneity.

These patients suffer from increased nasal secretion and more or less occlusion of the nasal passages, aggravated by damp weather or by colds in the head. Headaches are common, and the senses of taste and smell are often obtunded. The voice may lack the nasal resonance, and the patient may breathe through the mouth. A profuse watery discharge is common, and epistaxis is not infrequent.

Mucous polypi are to be distinguished from deviation of the septum, thickening of the turbinated bodies, chronic septal abscesses, foreign bodies, and from fibrous and malignant tumors.

Careful inspection with the rhinoscope and the use of the flat probe will usually serve to distinguish polypi from deviation of the septum, enlarged turbinals, and chronic abscesses. The secretion from foreign bodies is usually offensive; not so with polypi.

Fibrous and malignant tumors are usually of deeper color and more resistant to the touch. They bleed easily, and the malignant growths have a more irregular surface and cause more pain and disfigurement. In rare instances these growths become sarcomatous.

The affection, if not relieved surgically, continues for a lifetime, though spontaneous expulsion of one or more polypi may occur. They are likely to recur after removal, but local medication appears of some service in preventing this.

Treatment.—Numerous topical applications have been suggested

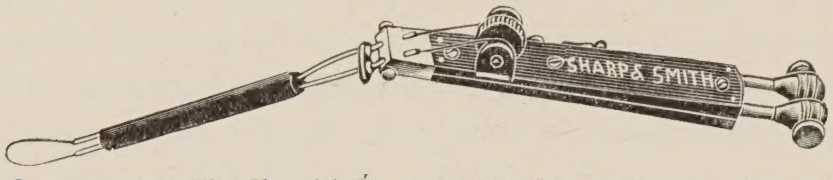
[1] *Annual of Universal Medical Sciences*, 1896.

for the cure of polypi, and various substances have been injected into them for their destruction. Among the latter are zinc chloride, iodine, alcohol, carbolic acid, and solutions of iron perchloride. The application of saturated solutions of potassium bichromate and the introduction of chromic acid into the tumor have also been recommended. Success appears to have occasionally followed these methods, but they have certainly generally failed; therefore we must resort to operative procedures in all cases when the polypi cause inconvenience.

Evulsion with forceps, the oldest method, is still commonly practised, but should give way to the more precise methods practised by laryngologists.

The galvano-cautery écraseur (Fig. 11) affords the advantage of searing and thus destroying the base of the polypi. The instrument

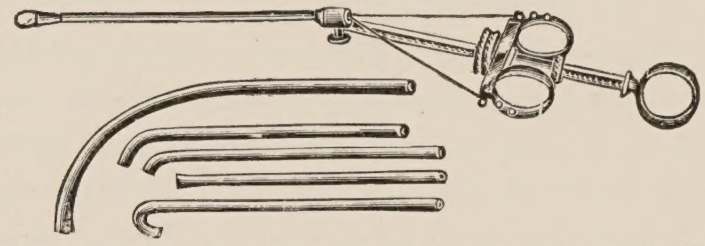
FIG. 11.



Galvano-cautery Handle with Écraseur Attachment (one-quarter size).

is, however, rather clumsy, compared with the ordinary steel-wire snare (Fig. 12), some form of which is now in general use by laryn-

FIG. 12.



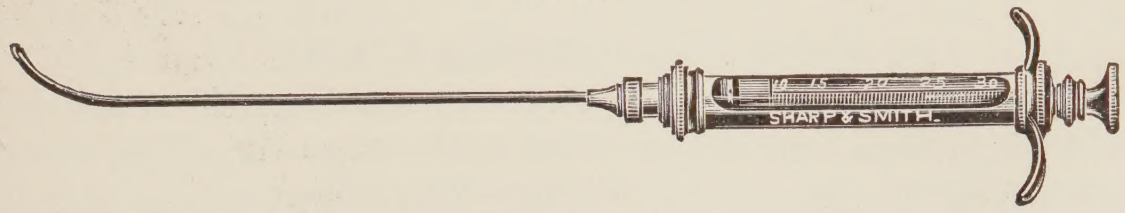
Ingals' Snare, with extra Tubes (one-quarter size, angle 25°).

gologists. It should be armed with No. 5 piano wire. The loop is passed from beneath up about the polypus, and with a backward and forward movement is worked up as near the base as possible. The loop is then firmly tightened and the polypus pulled off, unless it happens to be attached by a broad base, when it must be cut off with the wire. Sometimes both cavities may be cleaned at once, but it is better to remove what growths are in easy reach, and complete the operation in one or more subsequent sittings.

Occasionally, if not usually, the polypi bud again after removal, in which case the best treatment consists in thorough searing with the galvano-cautery while the buds are still small. For the primary operations or cauterizations the parts should first be thoroughly anæsthetized with a 4 per cent. solution of cocaine, which is best applied by means of a hypodermic syringe fitted with a long blunt silver

nozzle (Fig. 13), bent at the end so that the solution may be thrown up about the base of the tumors. After removal of the polypi we should make free use of a spray containing $\frac{1}{3}$ grain of thymol, 3

FIG. 13.



Hypodermic Syringe (one-half size). Silver nozzle.

minims of the oil of cloves, and 10 minims of terebene to the ounce of liquid albolene, which keeps the part clean and appears to have some effect in preventing recurrence.

Often operative procedures must be repeated several times until complete destruction of the growth is effected.

NASAL FIBROUS POLYPI.

Fibrous polypi are of extremely rare occurrence in the nose, but are not uncommon in the naso-pharynx. They are harder and bleed more easily than mucous polypi, and are not at all subject to medical treatment. They should be removed when possible by the natural passages by scissors, snare, or, better still, by the galvano-cautery écraseur, provided it can be accurately applied.

NASAL TUMORS.

NASAL papillary tumors are quite infrequent, but are occasionally found, varying in size from one to fifteen millimetres in diameter, and springing from the septum or lower turbinated body. They occasion symptoms of dry catarrh, with the signs of more or less obstruction.

Treatment.—These growths may be destroyed by nitric, acetic, or chromic acid, the curette, or the galvano-cautery, but in some cases they promptly return in spite of the most careful operations. In a most obstinate case of the kind I have seen, speedy cure from the application to the warts, two or three times daily, of the fluid extract of Thuja occidentalis, and the internal administration of drachm doses of the same. It is impossible to explain the modus operandi of this drug, but there can be no doubt of its beneficent effects, at least in some cases.

NASAL VASCULAR TUMORS.

Angiomata or vascular tumors of the nose are very rare. They do not appear amenable to medicinal treatment. Care must be taken

in their removal to avoid after-bleeding. If the cold-wire snare is used, the process of removal should occupy many minutes or even one or more hours. It would seem that the galvano-cautery would be the best instrument in these cases.

Nasal Cartilaginous Tumors.

True cartilaginous tumors, or ecchondromata, are seldom found in the nasal cavities, but a few cases have been reported. They closely resemble fibrous polypi; they are, however, sessile, generally growing from the cartilaginous septum, and if not interfered with may attain enormous size, causing great deformity of the face. The tumor is hard, but can be readily penetrated by a needle and does not bleed easily. If detected early before great deformity has resulted, the prognosis is favorable.

Treatment.—They may be removed most satisfactorily by the galvano-cautery écraseur, but may be destroyed by electrolysis.

Nasal Bony Tumors.

These very rare tumors are usually ovoid in form, and may be from a few millimetres to several centimetres in diameter, and may be dense or cancellous in structure. They usually have but little if any bony attachment, but are covered by periosteum and mucous membrane. These growths, as a rule, soon cause intense itching, which is later followed by nasal obstruction, offensive discharge, impairment of the sense of smell, and frequent epistaxis. Extremely severe neuralgic pains often result from the pressure of the tumor upon the adjacent parts. Deformity or perforation of the external parts may gradually take place.

Bone-tumors are distinguished from exostoses by their movability, larger size and darker color; from rhinoliths by the mucous covering and smooth instead of crumbling surface; from malignant growths by their slower growth and denser structure.

Treatment.—The treatment must be operative. After crushing the softer forms by means of strong forceps, the fragments may be removed. The hard variety, which is more common, may be ground down or drilled through with the dental burrs or trephines, and subsequently broken; but if very large, an external incision is usually necessary for their removal.

Nasal Malignant Tumors.

Malignant tumors of the nose are characterized by rapid growth, severe pain, nasal obstruction, offensive discharge, and frequent epistaxis. They are generally sarcomatous, but may be carcinomatous. On inspection their surface appears rather pale, nodular, or raspberry-

like, and bleeds easily when touched with a probe. The sarcomata usually spring from the osseous tissue, and may be osteo-sarcomata. The carcinomata take their origin from the mucosa. The latter are more likely to invade the adjacent lymphatics, and do not bleed as easily as the sarcomata.

These tumors cause alterations in the voice and other symptoms common to all nasal tumors. There are usually a greenish, offensive discharge, frequent epistaxis, and great pain in the infraorbital region. As the tumor grows the bony structures of the nose may be separated or pushed forward. The eyeballs may protrude and the tumor extend to the brain. Constitutional symptoms and the usual cachexiæ may follow later. If removed by operative measures, these growths speedily return, and usually run a rapid course, terminating fatally within six months.

Treatment.—Sedatives and astringents may be applied for palliative effect. Treatment by injections of toxins of erysipelas and bacillus prodigiosus has not proved successful. Thorough eradication, when practicable—which unfortunately is not often the case—is the only treatment that affords any chance of success.

SYPHILIS OF THE NOSE.

Syphilis of the nose is a local manifestation of constitutional syphilis, and may be primary, secondary, tertiary, or congenital.

The nasal mucosa may be ulcerated or simply thickened in patches, the latter condition sometimes being extensive enough to cause obstruction. Involvement of the periosteum or perichondrium sometimes happens, and suppuration with cartilage- and bone-necrosis naturally results.

Primary syphilis of the nose is rare. The secondary form is not infrequent, especially in infants, in whom it is apt to appear about the third or fourth month, its manifestations at that time being known to the laity as snuffles. Tertiary lesions are seldom noticed until several years after the initial lesion, but they may occur earlier. In the secondary stage there is profuse offensive muco-purulent secretion and more or less nasal obstruction, calling for frequent washing of the parts. Condylomata are sometimes present, and mucous patches are occasionally seen at the angle of the nostril or on the mucous membrane, and the fauces usually show evidence of the disease. In the tertiary stage necrosis of the cartilaginous or bony septum or of the turbinated bodies occurs, accompanied by a most offensive odor of dead and decaying tissue. The dead bone presents a blackish, rough surface, which imparts a grating sensation when palpated with the probe. Extensive destruction of the nasal bones causes falling in of

the bridge of the nose, and necrosis of the palate makes an entrance into the mouth. In rare instances, even when no dead bone is present, an offensive odor continues, even though the parts are kept clean by frequent washings. This condition can only be relieved by the free use of deodorants, such as thymol and aristol.

The secondary stage of the disease can be distinguished from simple chronic rhinitis by the history of its sudden onset with pronounced symptoms, by the mucous patches and condylomata when present, and by the history of the primary lesion when obtainable.

Lupus can be distinguished from the tertiary stage by its occurring at an earlier age than syphilis, excepting the hereditary form; by the peculiar reddish papules or tubercles of lupus; and later by its attacking the cartilage instead of the bone.

The odor of atrophic rhinitis, though offensive, differs from the penetrating stench of syphilis, and no necrosed tissue is found in the former disease.

In all doubtful cases old scars or induration of the tongue, pharynx, or larynx, and finally the beneficial action of potassium iodide, usually make it possible to make an accurate diagnosis, without which no intelligent treatment can be given. In mild cases secondary or tertiary symptoms usually speedily disappear under proper anti-syphilitic treatment, but after caries has taken place the prognosis is much less favorable. The severity of the disease appears to depend not only upon the virulence of the syphilitic virus, but also upon individual constitutional peculiarities.

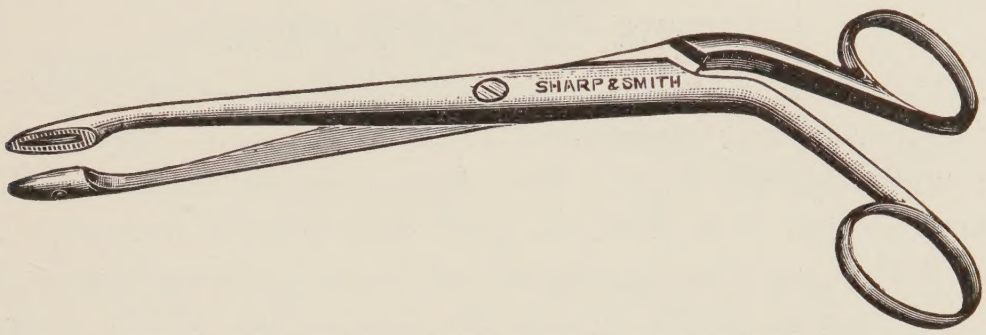
Treatment.—For the treatment of the secondary stage mild constitutional remedies, together with local applications of tincture of iodine or silver nitrate to the mucous patches or condylomata usually suffice. More vigorous treatment, both constitutionally and locally, is demanded in the tertiary stage. Potassium iodide and sodium iodide in moderate doses, steadily increased if necessary up to their physiological limit, are of the utmost importance. In all cases some form of specific medication should be continued for about a year after active symptoms have disappeared. During the active disease of the nose the parts should be thoroughly cleansed two or three times a day with some alkaline wash. Topical applications of silver nitrate, gr. xl to 1 to the ounce, of sulphate of copper, gr. x to xx to ℥j, or full-strength tincture of iodine, should be made every day or two, if deep ulceration exists.

If dead bone is present, it must be carefully removed with forceps (Fig. 14), provided this can be done without force, or parts that cannot be thus removed may be cut away when within reach of the bone-forceps.

Congenital syphilis of the nose usually appears within the

first month after birth, and seldom later than the second month, but occasionally not until the eighth year or even later. The early symptoms are those of cold in the head with coryza, but within a few weeks the secretion becomes thicker, causing obstruction to nasal

FIG. 14.



Ingals' Nasal Dressing Forceps (three-fifths size).

respiration and emitting an offensive odor. Caries may ensue, causing disfigurement and extreme fœtor. Such children usually suffer from marasmus, and they are generally short-lived, but some are apparently cured.

Potassium iodide and preparations of mercury are indicated internally for their specific effects, and if possible local treatment should be carried out as recommended for syphilitic disease of the nose in adults. Ferruginous and bitter tonics, with malt, cod-liver oil, or other nutrients are of quite as much importance as the specific medication.

TUBERCULOSIS OF THE NARES.

THIS rare affection is characterized by the formation of tubercles of varying size, followed by ulceration and a fœtid discharge. It is caused by the bacillus tuberculosis, and is usually secondary to some other tubercular process. Thickening of the mucosa, with or without ulceration, is commonly present. The tubercles vary from two to thirty millimetres in diameter, but they are generally small and of a grayish-white color. The ulcers that follow may be single or multiple, and have a smooth grayish base and frequently raised edges. These ulcers are apt to appear upon the ala. The affection begins insidiously, and generally progresses slowly. The ulcers become painful, and later constitutional symptoms develop from the presence of tuberculosis of the lungs or larynx.

The diagnosis depends upon finding tuberculosis in other parts or upon detecting the bacilli in the discharges or scrapings from the ulcers. The disease may extend over many years. When other organs become involved, it runs a more rapid course, terminating fatally.

Treatment.—Tumors which obstruct the nares should be removed.

Lactic acid in varying strength, from 30 to 50 per cent., is of service in healing up the ulcers. The system should be fortified by tonics, and carbonate of creasote, oleum caryophylli, or other antiseptics should be given internally in large doses long continued.

LUPUS OF THE NARES.

Pathologists now generally recognize lupus as a tubercular disease, but there is still much doubt on the subject, so we here describe it briefly under the old name. The disease usually begins on the cartilaginous septum in the form of small red, irritable nodules. These gradually coalesce, forming uneven patches which later become ulcerated. The disease slowly invades the surrounding tissues, destroying soft tissue, cartilage, and even bone. While the destruction is extending a process of healing by white scar-tissue may be taking place at some points. The disease is not usually painful, but is accompanied by more or less offensive discharge, demanding mild alkaline detergent washes.

Treatment.—The local treatment consists in the removal of the diseased tissue with knife, curette, caustic, or the galvano-cautery. After thorough curetting lactic acid may be applied repeatedly until the reparative process is established. Nitric acid, caustic potash, and zinc chloride are also sometimes used for the same purpose.

DISEASES OF THE NASAL SEPTUM.

Deflection of the Nasal Septum.

Deflection of the nasal septum is one of the most common deformities of the nose. It is usually associated with thickening of the cartilage and bone or enchondroma and exostosis.

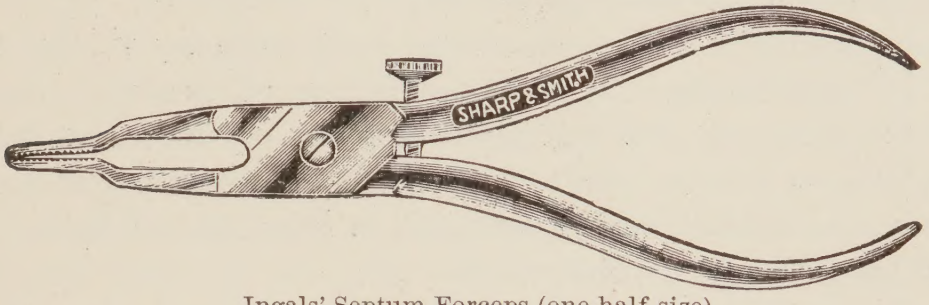
The cartilaginous septum, and sometimes the bony septum, or even both parts, may be bent to one side, the cartilaginous portion, as a rule, being chiefly involved. One naris is thus enlarged at the expense of the other. There is usually thickening of the septum, especially at the lower part of the concave surface. Comparatively few cases can be traced to injury, and I agree with Delavan that in most cases it is due to hypernutrition brought about by chronic congestion of the part. The patient seeks relief because of the obstruction to nasal breathing, collection of secretions in the nares and naso-pharynx, and the nasal twang to the voice.

Treatment.—Operative measures alone are capable of accomplishing much good in this affection.

In slight deviations most excellent results may be attained by making a crucial incision through the cartilage, the cut being made

obliquely so that the bevelled edges will easily slide past each other. The septum is then forced into place by forceps (Fig. 15), the vomer

FIG. 15.



Ingals' Septum Forceps (one-half size).

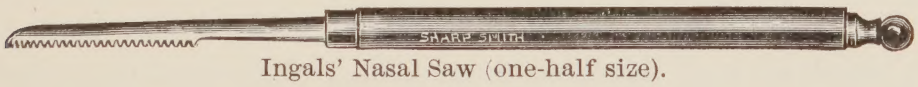
being fractured if necessary, and a gutta-percha plug or tube of sufficient size is kept in the obstructed nostril until union has taken place. In cases where the cartilage is bent almost at right angles the mucous membrane may be dissected up, a triangular piece of cartilage excised, the cartilage incised farther back to destroy its resiliency, and a plug placed in the obstructed nostril. Even then the cartilage may return to near its former position and prevent a satisfactory result.

Incisions made by a small trephine beneath the mucous membrane, and the removal of the cores thus made, seem to destroy the resiliency of the cartilage better than other means. The after-treatment is the same. Perfect results are difficult to obtain.

ENCHONDROMA AND EXOSTOSIS OF THE NASAL SEPTUM.

Enchondromata and exostoses of the nasal septum consist of thickening of the cartilaginous and bony parts of the septum with a more

FIG. 16.

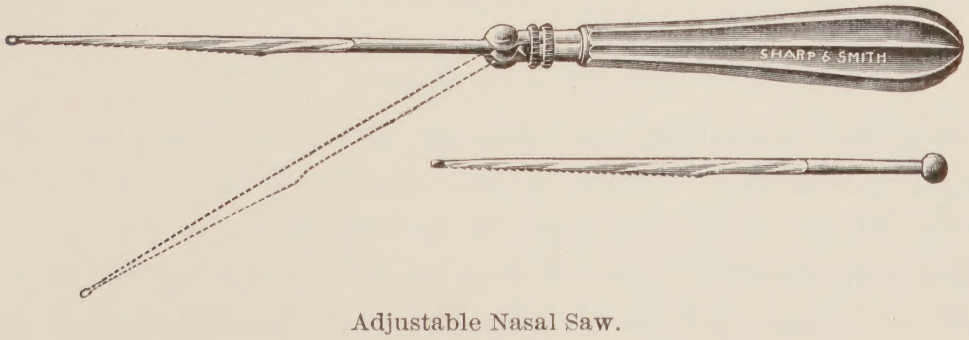


Ingals' Nasal Saw (one-half size).

FIG. 17.

Ingals' Flat Nasal Saw (two-fifths size).

FIG. 18.



Adjustable Nasal Saw.

or less prominent outgrowth or spur in most cases, and usually some deflection. The spur may be small, or so large as to impinge upon the outer wall of the naris and produce severe neuralgic pains.

Treatment.—The obstruction may be completely removed by suitable operation. Before operating both surfaces of the septum should be anæsthetized by the application of cocaine. An effort should be made to save as much mucous membrane as possible. Enchondromata may be cut away with the knife or by the trephine. They can also be thoroughly removed in from one to three sittings without hæmorrhage by electrolysis.[1]

Exostoses may be removed by saw or trephine and burr. The saw (see Figs. 16, 17, 18) is quicker and more accurate, and should be employed when possible. Perforation of the cartilaginous septum should always be avoided, and an opening in the bony septum should not be made if sufficient room can be secured without it.

Perforation of the Nasal Septum.

Perforation of the septum is often found as a result of syphilis, but it also not infrequently occurs in persons of low vitality or following typhoid fever, pneumonia, and phthisis.

Treatment.—The treatment consists in making suitable applications to heal any ulceration which may be present. Operative interference is not necessary, would be very difficult, and would result in very little if any good.

Hæmatoma of the Nasal Septum.

Hæmatoma is the name given to a collection of blood between the deep layers of the mucous membrane and the underlying cartilage of the nose. It usually results from fracture of the bony or cartilaginous septum, and presents a smooth, purple swelling just within the nostril, usually soft and fluctuating, and symmetrical on both sides. Hæmatomata usually eventuate in a few days in abscesses, and terminate with recovery, leaving a perforated septum as a rule.

Treatment.—First try cold applications. If suppuration takes place, evacuate upon one side, this usually being sufficient to drain both sides.

Abscess of the Nasal Septum.

These abscesses may be acute or chronic. They are found in the same position as hæmatomata, just described. They may result from the latter or follow simple inflammation of the parts. Redness and swelling of the dorsum of the nose and neighboring parts always

[1] Casselberry, *New York Medical Journal*, Aug. 31, 1895.

exist. The treatment is essentially the same as that of hæmatomata of the septum.

FOREIGN BODIES IN THE NOSE.

Beans, peas, buttons, or pebbles are the most common foreign bodies found in the nose. They are usually placed there by children, and often by insane people. Occasionally bodies are lodged in the nose during the act of swallowing. They sometimes remain a long time without symptoms, but substances which absorb moisture soon swell and obstruct the nose. These bodies often cause headaches,

Fig. 19.

Gross's Instruments for Removing Foreign Bodies from the Nasal Cavities and Ears.

but the most characteristic feature is a more or less profuse and offensive discharge from one nostril. A foreign body in the nose is to be distinguished from other causes of nasal obstruction and simple catarrh by the history, by the offensive discharge from one nostril, and by careful inspection and palpation with the probe. The application of cocaine often assists in detecting foreign bodies. Such cases are often treated for months, or even years, with douches or sprays by careless physicians, but necessarily without benefit.

Treatment.—The nasal cavity should be cocainized and the substances removed with forceps, catheter, probe, hooks, screws, douche, or snare, the latter being the most generally applicable. Mild alkaline antiseptic washes may be used for a week or ten days thereafter.

Rhinoliths.

Rhinoliths are concretions in the nasal cavities. Phosphate of lime is gradually deposited around a foreign body, forming a rhinolith, which is hard and rough on the surface and often softer toward the centre.

The symptoms are similar to those caused by a foreign body, the most characteristic being the offensive discharge from one side. If imbedded in the mucous membrane, there is apt to be ulceration and bleeding. They may remain many years, causing much annoyance, but are not dangerous to life.

Treatment.—They may usually be removed with polypus-forceps or the snare, or they may sometimes be crowded back into the nasopharynx and thus expelled. If necessary, they can be broken up by means of nasal bone-forceps and removed in fragments. The same after-treatment is desirable as for foreign bodies.

MYIOSIS NARIUM.

Myiosis narium, or maggots in the nose, results from the hatching of eggs deposited by flies in or near the nostril. This disease usually causes much destruction of the soft parts and may destroy even the bone. There are offensive discharge, severe pain, insomnia, and occasionally convulsions. The mucous membrane becomes first irritated, then crawling sensations may be experienced. Inspection of the nares reveals the presence of the maggots. As many as two or three hundred have been expelled from the nose in a single case. If neglected, the case may prove fatal.

Treatment.—Inhalations of chloroform may suffice for the destruction of the parasites. But if this is not sufficient, the patient should be anæsthetized and pure chloroform injected into the nasal cavities with a syringe. This does not appear to injure the mucous membrane severely, but would be very painful without complete anæsthesia. Bond of London[1] successfully used dilute Mandl's solution, 15 minims to the ounce.

DISORDERS OF THE SENSE OF SMELL.

Parosmia is a perverted sense of smell, the patient experiencing sensations of odors, usually disagreeable, which are not present. It is quite common among epileptics and the insane. It may be present constantly or only at times.

The disease is very frequently associated with anosmia, and may have for its seat the distribution of the olfactory nerves, in which case local treatment, as described under Anosmia, may yield satisfactory results.

Anosmia is the loss of the sense of smell. It is dependent upon obstruction in the nares or disease of the olfactory nerves or their cerebral centres. It may be unilateral or bilateral, and may come and disappear for a time, and return again, without apparent cause. When due to mechanical obstruction, anosmia disappears with the removal of the cause. When due to catarrhal inflammation of the nasal mucous membrane, recovery usually occurs, unless it is of two or three years' standing. If of cerebral origin, recovery seldom occurs.

Treatment.—The cause should be removed if possible. When this cannot be detected, Mackenzie recommends the insufflation of a powder containing $\frac{1}{24}$ grain of strychnine with 2 grains of starch, twice a day if necessary. Joel of Mont-Dore[2] cured two cases of loss of smell and taste which had existed for several months, and which had been unsuccessfully treated by irrigation, the galvanocautery, electricity, and strychnine insufflations, by the employment of carbon dioxide gas applied by an ordinary seltzer siphon. This

[1] *Journal of Laryngology*, May, 1896. [2] *London Lancet*, 1895.

was turned upside down, the excess of liquid allowed to escape through the tap, and the orifice then placed close to the nostrils.

DISEASES OF THE ANTRUM OF HIGHMORE.

TUMORS of the antrum are not at all uncommon. They usually originate from the alveolar border. They are, in the order of frequency, carcinomata, sarcomata, osteomata, fibromata, myxomata, and cysts.

Benign growths can be removed by exposing the interior of the antrum though the necessary incision and opening into its anterior wall.

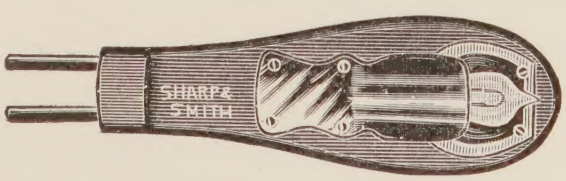
In malignant growths the operation consists essentially of removal of the upper jaw. In many cases operation is contraindicated on account of the age of the patient, his low vitality, or the involvement of inaccessible parts; in which case nothing but palliative measures can be employed.

EMPYEMA OF THE ANTRUM OF HIGHMORE.

Empyema or abscess of the maxillary sinus is a common affection resulting usually from caries of the root of a tooth, but also from inflammatory lesions of the nares, and sometimes from nasal polypi. The affection is attended by pain radiating in various directions from the seat of the disease, swelling of the overlying tissues, in some cases more or less obstruction to the nose, discharge from one nostril, and a foul smell or taste which cannot be removed by nasal washes of any character. The discharge comes from one naris only, and is usually intermittent, occurring only in certain positions of the head. On inspection the pus may sometimes be seen entering the naris in the middle meatus. Tenderness may be elicited on palpation over the malar prominence on the affected side, and there may be marked redness of the gum corresponding to the side affected.

The disease may be mistaken for ozæna, disease of the frontal sinuses or of the ethmoidal cells, or for tumors, cystic growths, and foreign bodies in the antrum. Pus in the antrum may be detected by

FIG. 20.



Ingals' Electric Lamp for Transillumination (one-half size).

injecting peroxide of hydrogen through the normal opening, when, if pus be present, a discharge of froth will take place. Transillumination often aids in a correct diagnosis. A small lamp (Fig. 20) placed

in the mouth of the patient in a dark room will cause a rosy illumination of the cheeks, lips, and lower eyelid on the healthy side. But if the antrum is filled with pus, the cheek and lower lid will remain dark. If the room cannot be darkened, a photographer's focusing cloth thrown over the heads of both patient and physician will exclude the external light sufficiently. Dr. Henry Ohls of Chicago has described a new method of transillumination by an ordinary cautery electrode, protected by a two-drachm vial (Fig. 21). This "home-

FIG. 21.

Dr. Ohls' Lamp for Transillumination.

made" lamp can be used in connection with any cautery battery. Care must be taken not to leave the current on too long at a time, for fear of burning out the electrode. Solid tumors and foreign bodies would also render the affected side opaque, while cysts light up more distinctly than the healthy cheek.

Cases are apt to be prolonged even under the most approved surgical measures.

Treatment.—When pus has formed, a free opening for its evacuation is usually necessary, although some cases have been cured by irrigation through the natural passages with pyrozone or other antiseptic solutions, applied with the long-nozzled syringe. This treatment, however, is usually difficult and unsatisfactory.

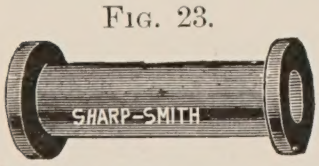
The antrum may be opened through the nose, through a tooth-socket, or through the anterior wall above the alveolus. Probably the best results are obtained by the opening through the tooth-socket. This can be accomplished by trephines or drills. The Brainaid conical bone-drill is a favorite (Fig. 22). The opening thus made will close in a

FIG. 22.

Brainaid's Bone-drill.

few weeks unless kept free by some form of drainage-tube, as for example, that illustrated in Fig. 23. Subsequently the cavities must be kept clean by irrigation with antiseptic solutions.

FIG. 23.



Ingals' Drainage-tube for Antrum (full diameter; three different lengths).

Various stimulating solutions or powders will also be needed, and care in plugging the opening before eating must be taken to prevent entrance of particles of food.

DISEASE OF THE SINUSES.

EMPYEMA of the sphenoidal sinuses is a rare affection, and when found is very difficult to treat successfully. It usually causes severe headache, and is accompanied by a discharge of pus, which generally escapes through the naso-pharynx instead of the nostrils. The senses of smell and sight may be more or less disturbed. The abscess may open spontaneously, and, if not, the sinuses should be perforated and treated by irrigation, as in empyema of the antrum.

Inflammation of the frontal sinus may be acute or chronic. The acute form is the result of extension from the nasal mucosa or adjacent bone, or of direct infection through a wound. The chronic form is usually due to syphilis or tuberculosis. The chief features are pain and headache, a sense of weight and fulness in the forehead, with, usually, coryza. There are swelling, tenderness, more or less fever, rigors, and may be delirium. The situation of the duct of the sinus usually allows the escape of the inflammatory products, and in simple catarrhal cases a spontaneous cure results; but when swelling obstructs the duct the secretions distend the sinus and produce severe symptoms. The application of cocaine three or four times a day may reduce the swelling and allow the escape of the secretion, so that a cure follows.

The contents of the sinus may undergo suppuration, causing empyema, and demanding surgical interference. The sinus may be opened from the nasal cavity by a small drill, or from the external surface by trephine or chisel, the object being to institute thorough drainage of the cavity. Subsequent irrigation and stimulation are to be used as in suppuration of the other sinuses.

DISEASE OF THE ETHMOID CELLS.

INFLAMMATION of the ethmoid cells usually causes severe neuralgic pains over the orbit and a muco-purulent discharge, generally from one side of the nose. Not infrequently small polypoid growths are associated with the ethmoid disease.

Treatment.—The object of the treatment should be to remove any obstruction to the free exit of pus and to render the parts as clean and aseptic as possible. The cells may be cleansed by injecting boric-acid solutions, pyrozone, or other antiseptics. The patient may advantageously use at home a stimulating antiseptic spray consisting of thymol gr. $\frac{1}{3}$, oil of cloves ♏ v, terebene ♏ x, to the ounce of liquid albolene. Washing the nose twice daily with an alkaline solution, as, for example, the Rhodes tablets (page 163) assist greatly in keeping the parts clean. But even with the most persistent treatment the disease

may last many months or even years, but a few cases seem to recover spontaneously.

RHINO-PHARYNGITIS.

Rhino-pharyngitis, commonly called post-nasal catarrh, is usually a chronic affection resulting from nasal obstruction. It is most frequent in a cold, moist climate, and is sometimes excited by a dusty atmosphere. Excessive smoking, drinking, and breathing bad air also produce the affection.

An examination with the rhinoscope discloses the presence of tenacious secretion coming down back of the soft palate, a collection of muco-pus in the naso-pharynx, or firmly adherent dry crusts extending from the pharynx up into the naso-pharynx. The mucous membrane usually appears congested. The posterior ends of the turbinated bodies may be enlarged or the mucous membrane at the sides of the vomer thickened. The orifices of the Eustachian tubes may be either swollen, congested, or occluded by secretion. There is a frequent desire to hawk and clear the throat of the viscid secretion, especially in the morning and after eating, the effort in many cases causing nausea or even vomiting. There are often a sense of dryness in the throat and offensive breath from decomposing secretions, and the hearing is often obtunded.

Treatment.—Many mild cases never apply for treatment. Well-developed cases require a great deal of patience on the part of both patient and physician. Direct causes, as nasal obstruction, adenoids, and the like, are to be removed. Exciting causes, as exposure and bad, unhygienic surroundings, must be avoided. The digestive organs must be kept in a healthy condition, and constitutional treatment is to be instituted if indicated. Locally, cleanliness of the nares and naso-pharynx is to be sought after. Gargles are seldom of much use, but sprays and washes are serviceable. Washing by snuffing the solution through the nose from the palm of the hand or by means of nasal or post-nasal syringes (Fig. 24) is efficacious in removing the secretions

Fig. 24.

Post-nasal Syringe (two-fifths size).

and preparing the parts for local applications. While using the wash the patient should keep his mouth open, and should be careful not to swallow. He must also use very little force, so that the fluid will not pass into the Eustachian tubes. The solution should be applied lukewarm. Dobell's solution or a simple alkaline preparation of

equal parts of sodium bicarbonate and sodium chloride, 1 drachm of the mixture to the pint of water, may be used, or Rhodes' tablets may be employed. After cleansing, astringent or stimulating powders are of much service. Much benefit is derived from the occasional use of a powder containing 1 part of berberine muriate to 1 or 2 of acacia. This should be gently forced through the bent tube of the insufflator up back of the palate, so as to cover the vault of the pharynx and lodge in the naso-pharynx, the patient being instructed to retain the powder as long as possible.

Some authorities recommend painting the surface with strong solutions, such as silver nitrate, 5 to 10 per cent., or tincture of iodine, about half strength.

For relief of the dry sensation an oily spray containing carbolic acid, from 2 to 5 grains, and menthol 1 to 2 grains to the ounce of liquid albolene, gives good results when applied to the diseased surface.

Throat Deafness.

Diseases of the nares and naso-pharynx often involve the Eustachian tubes and extend to the middle ear, thus causing most of the cases of deafness. Whatever causes obstruction to the Eustachian orifice or canal may induce rarefaction of the air in the tympanic cavity, and if long continued will cause depression, with inflammation and thickening, of the membrana tympani, and consequently more or less complete deafness. The patient usually complains of a sense of fulness in the ears and of rumbling, roaring, and buzzing sounds. Sometimes, if the deafness is due to obstruction at the Eustachian orifice, it will subside, or may be cured by mildly astringent or stimulating applications, like those already recommended for rhino-pharyngitis; but when much thickening of the lining membrane of the tube has taken place, with consequent changes in the middle ear, as in most cases of long standing, we may be well satisfied to check the progress of the disease and prevent an increase in deafness.

Treatment.—First find the cause, if possible, and if due to nasal or pharyngeal obstruction, such as caused by exostoses, tumors, adenoids, or the like, it should be removed by the methods recommended under their respective headings, and post-nasal catarrh must receive its appropriate treatment. When this does not suffice, direct treatment to the Eustachian tube is employed. It may be necessary to supply the drum-cavity with fresh air by means of Politzer's method, or, if the catarrhal inflammation has extended to the tympanic cavity, remedies may be introduced into the tympanic chamber by the Eustachian catheter, or by medicated oleaginous sprays thrown up behind the palate with an atomizer having a long bent tip, the nostrils and mouth being closed at the time, or thrown through one nostril, all escape at

the nostrils being prevented, as in using the Politzer bag. The treatment is taken up more in detail under Diseases of the Ear.

Retro-nasal Fibrous Tumors.

Polypi as they appear in the naso-pharynx usually originate from the periosteum, and may be almost entirely fibrous. The more fibrous in structure the more vascular they are. They may attain very large size, and produce great disfigurement, known as frog-face. The affection is rare, and occurs usually in children and young adults, the tendency to this growth usually disappearing by about the twenty-fifth year. These tumors cause nasal obstruction and frequent epistaxis, and appropriate treatment necessarily depends upon a correct diagnosis.

Treatment.—Fibrous tumors should be removed through the nares or naso-pharynx, if possible, by means of the cold-wire snare, galvano-cautery snare, or by electrolysis. On account of the firmness of the tissue and its vascularity, the galvano-cautery écraseur is preferred. When the tumor is of large size the operation assumes grave aspects and presents many difficulties, but in experienced hands the life of the patient is safer with the operation than without it. Medical applications to the surface are of very little value, excepting as detergents, and the author has seen one case where weak solutions of carbolic acid repeatedly caused hæmorrhage, apparently due to the carbolic acid, as other solutions did not have this effect. Injections of lactic acid, strength 20 to 35 per cent., with carbolic acid, 3 to 5 per cent., in water, preceded by a little cocaine, has proven very beneficial in reducing the size of the tumor and preventing recurrence after its removal.

Hypertrophy of the Pharyngeal or Luschka's Tonsil (also known as Adenoid Growths).

This condition consists of an abnormal enlargement of the glandular tissues normally found in the vault and walls of the pharynx. The hypertrophied tissue appears quite evenly distributed across the vault of the pharynx, and consists of increased connective tissue and lymphoid structure, such as is found in hypertrophied faucial tonsils. The new growth may be quite firm, but is usually soft and friable, and is generally of a pinkish-gray color.

The cause of the disease is not well understood, so that but little light from this source is thrown on its therapeutics. It is often congenital; it may follow the exanthematous diseases, diphtheria, and repeated colds; the rheumatic and strumous diatheses seem to predispose to it. It is found usually in children but occasionally in young adults. It is characterized symptomatically by obstruction to nasal respiration,

excessive nasal secretion, and, in many cases, partial deafness, with alterations in the voice. The general health is often much impaired and the chest deformed; this being very noticeable in one of a pair of twins, who has enlargement of Luschka's tonsils, while the other has not, but is larger, stouter, and better formed.

The patient comes or is brought to the physician complaining of some or all of the following symptoms: mouth-breathing, snoring, partial deafness, nasal obstruction, catarrh, talking as if he had a "cold in the head," restlessness, and poor sleep at night, bad dreams, general debility, and possibly impairment of the mental faculties.

Upon examination of the naso-pharynx with the rhinoscope nodular or pendulous masses of a gray or pinkish color, with a smooth surface, are detected. In young or unmanageable children it may be necessary to palpate the naso-pharynx before an accurate diagnosis can be made.

Treatment.—In a great percentage of these cases the enlarged glands, untreated, would atrophy at about the age of puberty. But it must not be forgotten that a great deal of permanent damage may result in the mean time to the general health, the hearing, and voice. In fact, the advice which some physicians give to allow the child to outgrow the difficulty has been characterized as criminal. Removal of the diseased tissue is advised in order to improve the general health, mental development, and formation of the face and chest; to prevent inflammation of the Eustachian tube and middle ear; to prevent permanent alteration in the voice and increased danger from zymotic diseases. Even when of long duration, removal of the disease results very, if not most, satisfactorily.

As pointed out by the author in the *Journal of the American Medical Association* in 1894, "it is not uncommon for young children to gain within six months after the operation from 20 to 40 per cent. in weight, and correspondingly in vigor and endurance."

Where opposition is raised to an operation, or when for other reasons operation is impracticable, some benefit may be derived from the administration of the syrup of the iodide of iron. Calcium chloride also might cause in some cases reduction of the hypertrophied tissue. Local astringents have proved of some benefit in a few cases.

Successful results are obtained by the use of chromic acid. The applications are made by fusing a few crystals of this caustic on the end of a flat aluminum probe, and passing it through the nostril and into the pharyngeal tonsil, where it is held a few seconds. The soreness which follows for several hours is not severe. The treatment is to be repeated every four or five days until the growth disappears.

For the direct removal of the growth several methods may be

employed. Many operators scrape the gland away by means of a long finger-nail or a sharp curette. The galvano-cautery, with a bent electrode, is used by others, but is painful and rather unsatisfactory. Probably the most satisfactory instrument for this purpose is Lowenberg's forceps, or, better, John N. Mackenzie's modification of this instrument. In adults local anæsthesia by cocaine is usually a sufficient preparation for the operation, but in children chloroform anæsthesia is advised; in fact, a general anæsthetic is held necessary for a thorough removal of the growth. The final result, as stated above, is most satisfactory to the physician and friends of the patient.

The subsequent treatment should consist of mild antiseptic sprays and powders thrown through the nares. Those recommended after cauterization of the turbinated bodies answer an excellent purpose.

DISEASES OF THE UVULA, THE PHARYNX AND LARYNX.

By D. BRADEN KYLE, M. D.

While not including in the subjects treated in this article all those within the scope of the specialist, it is our aim to treat those most frequently seen in general practice, and, beside the treatment, as far as possible to give the points in pathology and etiology upon which any special treatment is based. The treatment given is that which my own clinical experience has proven to be most beneficial. Although others may obtain equally good results from other lines of treatment, to add these plans would not only exceed the space allotted to this article, but would also, by a multiplicity of drugs, add confusion.

DISEASES OF THE UVULA.

Diseases of the uvula without involvement of surrounding structure are of rare occurrence. There are, however, a few localized pathological conditions which demand at least brief notice.

Elongation of the Uvula.

Elongation may occur from a number of causes. In anæmic individuals, from general weakness, causing loss of muscular tone, there may be relaxation of the uvula giving rise to all the symptoms of elongation. In such cases general treatment should be instituted for the relief of the anæmia and for the improvement of the muscular tone. Should the symptoms produced be of sufficient severity, such as persistent irritating cough, asthmatic or choking attacks, or spasm of the glottis, demanding immediate relief, the application of strong astringents, such as nitrate of silver, 10 to 15 per cent. solution, or 10 to 20 per cent. chromic acid, every second or third day will give temporary relief. No local applications regardless of the cause will give permanent relief. The best results can be obtained by the forcible pinching of the tip of the uvula by means of ordinary forceps, or by the use of the hæmostatic forceps, being careful not to compress the tissue sufficiently to cause devitalization. When elongation occurs from involvement of structure in the naso-pharynx,

causing depression of the soft palate, thereby forcing the uvula down, the treatment should be directed to the offending structures and not to the uvula; the same is true where relaxation is due to partial paralysis following scarlet fever, diphtheria, and allied conditions. The common cause of permanent elongation is continued catarrhal inflammation of the posterior nasal cavity and naso-pharynx, causing not only elongation, but chronic thickening. Treatment should be instituted for the relief of the catarrhal condition, and, if the elongation is sufficient to produce pharyngeal irritation and constant hacking cough, relief can often be obtained by the compression method given above, the pressure being sufficient to set up considerable inflammatory process with subsequent organization and contraction. Should this procedure fail, the removal of a portion of the tip of the uvula is necessitated.

For this operation a number of special instruments have been devised and various methods suggested. These instruments are all no doubt useful, the objection to them being that they necessitate a straight cut, the portion removed leaving the entire tip denuded of epithelium with a flat scar resulting. If the uvula be rendered insensible by the application of a 3 to 5 per cent. solution of cocaine and the tip grasped firmly with a pair of ordinary straight forceps, care being taken to exert little or no traction, a wedge-shaped portion, with the point of the wedge up (the portion removed depending, of course, on the extent of elongation), can be removed by means of a small sharp bistoury—the advantages of this procedure being that the two flaps thus formed close together, leaving a mere line of scar and yet forming a long line for contraction, also that the lateral flaps protect the cut surface. This method requires no special instrument and in my own experience has been highly satisfactory. Care should be taken not to remove too much of the tissue. After the removal of the portion of the uvula, the parts should be sprayed every three hours with an antiseptic alkaline solution such as—

℞. Sodii bicarbonatis,		gr. viij (0.5);
Acidi carbolici,		gtt. iv (0.25);
Glycerini,		♏ xv (1.0);
Aquæ,	q. s. ad	f℥j (30.0).—M.

The patient should be directed to take no irritating foods for twenty-four to forty-eight hours. No irritating condiments should be used.

Hæmorrhage after Uvulotomy.—Usually the simple operation of uvulotomy is not attended by any serious results, the hæmorrhage occurring being only slight. When hæmorrhage does occur it is usually of such severity that the ordinary hæmostatics are of no avail.

The simplest method for the arrest of the hæmorrhage is to use the ordinary needle-holder carrying a curved needle, threaded with double silk thread, having the ends of sufficient length to permit of tying outside the mouth. The needle should be passed through the uvula laterally just above the cut surface and each thread tightened sufficiently to arrest the bleeding. This ligature will not necessitate any sloughing, with subsequent secondary hæmorrhage, as it can be safely removed in a few hours and sufficient clotting will have occurred before it has caused any destruction of tissue.

Ulceration of the Uvula.

Ulceration of the uvula is usually associated with ulceration of the adjacent structure, occurring in syphilitic and tubercular conditions or in any of the specific inflammatory processes. In such cases the treatment should consist of local cleansing of the parts by means of hydrogen peroxide, followed by an alkaline antiseptic wash such as boric-acid solution, 10 grains to the ounce, or the following:

℞. Sodii biboratis,
Sodii bicarbonatis, *āā.* gr. viij (0.5);
Acidi carbolici, vel
Toluol, gtt. j vel v (0.05–0.3);
Glycerini, gtt. xv (1.0);
Aquæ, q. s. ad f℥j (30.0).—M.

Also the administration of constitutional treatment as indicated in the articles devoted to the treatment of those special diseases. Ulceration following catarrhal processes should be treated by the same cleansing method, the surface dried, and then some stimulating powder should be applied. The stearate of zinc, containing salicylic or boric acid 30 to 60 grains to the ounce, should be used. The catarrhal ulcers are usually situated on the posterior part of the uvula and are often overlooked, therefore a careful rhinoscopic examination should be made in the cases of post-nasal catarrh in which the individual complains of the constant presence of secretion just above the palatine folds.

Œdema of the Uvula (Uvulitis).

As a rule, the sudden inflammatory process involving the uvula and producing œdema also involves the pharyngeal structure, but from localized irritation or trauma it may be limited to the uvula alone. It suddenly becomes swollen, boggy, and sacculated, producing a constant pharyngeal irritation and consequent cough, and causes pain on swallowing, especially when taking food. The uvula

may become so enlarged as to almost entirely cover the pharyngeal wall. When the process is rapid, causing sudden œdema, the surface should be coated over with a 10 per cent. solution of cocaine and the œdematous tissue filled with multiple punctures by means of a sharp-pointed bistoury, or, better, the double-cutting aspirating needle. During the puncturing, protection should be afforded the pharyngeal wall by placing back of the uvula some solid body; the short curve of an ordinary double retractor answers very well. After the puncturing the tissue should be thoroughly cleansed and coated over with some mild astringent such as tannin, 3 to 5 per cent. solution, or a weak solution of sulphate of copper, 1 to 3 grains to the ounce. Splendid results may be obtained by spraying the parts, after the puncturing, with ice-water.

Tumors of the Uvula.

Tumors of the uvula proper and not involving the adjacent structures are rare. Occasionally it may be the site of single or multiple papilloma. The tumor should be removed by means of the biting forceps, being careful to produce as little laceration of structure as possible, the necessary wound being treated by a cleansing alkaline solution.

Bifid Uvula.

This condition exists quite frequently, and although in itself it is strictly a malformation and not a diseased process, yet it may, owing to its shape, extent, and faulty action, give rise to tickling of the pharynx, followed by an irritating, hacking cough. Instead of removing one portion of the uvula, the inner surfaces of the two portions should be denuded, permitting the contact of the two granulating surfaces, and thereby forming complete union. If there has been slight elongation, the contraction following the scar-tissue formation will be sufficient to correct it without the removal of any structure.

DISEASES OF THE PHARYNX.

Acute Pharyngitis.

An acute inflammatory process involving only the pharyngeal wall may occur, but as a rule there is involvement of adjacent structures; even in less severe cases the posterior pillars are involved, while in severe cases the anterior and posterior pillars, the uvula, tonsil, and peritonsillar tissue are implicated.

The lesion may be due purely to a local irritation or may be a

local manifestation of some constitutional condition, or may be associated with or occur as a sequel of the latter. The symptoms produced, regardless of cause, are very much the same, and plans of rational treatment are naturally based on the etiological factors, either primary or secondary. First, then, treatment for the immediate relief of the distressing symptoms; and, second, the appropriate treatment for such conditions, constitutional or local, which may give rise to attacks of acute pharyngitis. For example, the attack may be due to intestinal or gastric irritation, or to a gouty or rheumatic diathesis; the general treatment, therefore, should be directed to the relief of the underlying cause. It must also be remembered that acute pharyngitis is frequently associated with, or really a continuation of, an acute inflammatory process of the post-nasal cavity. In such cases the treatment should be directed more to the naso-pharynx than to the pharynx proper. In the treatment of an acute inflammatory process of the pharynx it should also be borne in mind that for the performance of physiological function the tissue is richly supplied with blood-vessels and epithelial cells, and that after desquamation the surface epithelium is rapidly reproduced from its dense genetic layer. Besides the conditions mentioned above as etiological factors it must be remembered that the administration of certain drugs that are eliminated by the mucous membrane may be the cause of the inflammatory process. Of such drugs the iodine, bromine, and phosphorus preparations may be named. Their prompt withdrawal is usually the only treatment necessary.

When the inflammation is limited to the pharynx—and by the pharynx is understood that portion of the wall that is visible on oral inspection—the remedial agents should and can be applied directly to the part; this can be done in a number of ways: by means of gargles, sprays, the direct application by means of cotton and applicator, or in the form of lozenges. If the patient is seen in the early or first stage of the inflammatory process, the treatment indicated is vastly different from that demanded when it has reached the second or exudative stage. It must be remembered that in the first stage the pathological alteration is not a structural one, but is entirely limited to the vessels; that the mucous membrane has its normal lubricating secretion, which is furnished by the mucous glands located in the submucosa; that in the first stage, or stage of engorgement, the pressure exerted by the now over-distended arterioles and capillaries cuts off this normal secretion by the temporary occlusion of the excretory ducts, and therefore the surface will be dry and irritated. The object of treatment in this stage should be depletion and the rapid relief of the vascular engorgement. To accomplish this the same principles that are applicable to any other localized inflammatory

process should be employed here. The local or constitutional application of such agents as cause relaxation of tissue will bring about depletion, if not more rapidly, at least more in accordance with Nature's process, than by the application of astringents or remedies which contract the tissue. While it is possible to relieve the engorgement and cause contraction of the vessel, and even re-establish circulation and secretion in local spots of inflammation, yet the irritation produced by the application of such remedial agents to the delicate mucous-membrane surface may augment the very condition you are aiming to relieve. Instead, then, of the application of such solutions as iodine, nitrate of silver, etc., there should be administered locally and internally such drugs as pilocarpine, apomorphine, ipecac, tartrate of antimony, and other drugs in the same line. These should be administered in small and frequently repeated doses. An effervescing tablet containing $\frac{1}{100}$ of a grain of pilocarpine allowed to dissolve slowly in the mouth and repeated every hour for three or four doses will usually give relief.

The administration of drugs which act on the vasomotor system causing contraction of the vessel-wall may give the desired result and is preferable to the local application of any irritating agent. If the inflammatory process be localized, astringents may be used with good results, but if the process involves the entire pharyngeal surface they should not be used. If the throat is irritable or the raw feeling is present of which the patient so frequently complains, local sedatives should be used. The parts should be sprayed with a bland oil containing three drops of oil of sandalwood to the ounce, the oil of sandalwood being decidedly sedative to the mucous membrane and the bland oil serving the double purpose of a lubricant and a protector. To some patients the oily preparations are decidedly disagreeable; in such cases the surface may be sprayed with a weak cocaine solution not stronger than 2 or 3 per cent., the object being more to relieve the irritation than to cause contraction of the vessels. When menthol is used for the relief of this condition it should not exceed two grains to the ounce. If used in combination with camphor, much better results are obtained. The following usually gives relief:

℞. Camphoræ,	gr. ij (0.10);
Menthol. (crystal.),	gr. ij (0.10);
Olei santali,	gtt. iv (0.2);
Alboleni (liquid.),	f℥j (30.0).—M.

It is rarely necessary to administer internally drugs for the relief of this condition. Should the severity of the symptoms demand internal medication we have in codeine in small doses the best re-

medial agent. When the pharyngitis is not dependent upon purely local conditions, but is caused by gastro-intestinal or hepatic disturbances, immediate attention should be given to the gastro-intestinal tract. A purgative should be given, followed by a saline; such as the administration of one to three grains of calomel to one grain of compound colocynth powder, followed by a saline that will stimulate glandular secretion. This can be accomplished by the administration of two to four drachms of the granular effervescing phosphate of sodium, which may be repeated three times daily.

In the second or exudative stage where the vessels and glands have relieved themselves of engorgement, very little medication is required. If the secretions are profuse and tenacious the membrane should be cleansed with a simple alkaline wash. If the inflammation is localized, due to any of the above cases, and does not involve the entire pharyngeal surface, astringents may be used. Such solutions as tannin, 5 to 10 grains to the ounce; alum, 5 to 10 grains to the ounce, or chlorate of potash, 10 to 15 grains to the ounce, should be applied by means of sprays, or, better, by means of cotton and an applicator. When the inflammation is localized to the margins of the pharyngeal wall, which is often the case if dependent upon gastro-intestinal irritation, relief can be obtained by the use of a mild astringent such as the compound tincture of benzoin with equal parts of 50 per cent. boro-glyceride. Should the second stage not pass rapidly on into resolution, the hypersecretion and elaboration of mucus can be controlled by the administration of minute doses of belladonna in the form of atropine, or aconite in the form of aconitine—of either, the $\frac{1}{300}$ to $\frac{1}{400}$ of a grain—not repeated oftener than every three or four hours and only to the point of beginning physiological effects. These drugs apparently have a specific action on the faucial circulation. It is not necessary to confine the patient to his room unless the severity of the local condition leads to threatening constitutional symptoms.

Simple Chronic Pharyngitis.

Chronic pharyngitis is usually a secondary condition, not secondary to repeated attacks of acute inflammation, but associated with, or dependent upon, pathological lesions elsewhere, such as chronic naso-pharyngitis, gastro-intestinal irritation; cardiac, hepatic, or renal changes; also such conditions, as rheumatism and gout, where, by the presence in the blood and secretions of uric acid, and by its elimination from the mucous-membrane surface, there is established a slow chronic inflammatory process with increase in the connective-tissue elements. Generally in valvular lesions of the heart, especially mitral disease, there is a slowed venous circulation; in such cases there is a cyanotic condition produced in the mucous-membrane surfaces,

especially those surfaces which are surrounded or backed up by bony or cartilaginous wall; this is especially noted in the mucous membrane of the pharynx as well as in the continuous and contiguous structures. When due to obstructed circulation the thickening produced is entirely within and dependent upon the over-distended vessels, and thus the real condition existing in the tissue is that of a pressure-atrophy. This same condition may be produced by lesions of the kidney and liver in which, from fibrous contraction due to interstitial inflammatory processes, there is interference with the general circulation and secondary cyanosis of mucous membrane. These important points must not be overlooked, as curative treatment and accurate prognosis depend entirely upon their recognition.

As this condition is largely a secondary one the treatment should be directed toward the underlying etiological factor, as local treatment will be only palliative until the active cause has been removed. It would be impossible in this article to outline plans of treatment for the many underlying causes. For the relief of the local irritation and diminished secretion which are influenced by atmospheric change, stimulating solutions should be used. In the essential oils we have possibly the best remedial agents. The topical application by means of cotton and probe of the following I find to give the most relief:

℞. Ol. picis liquidæ,	gtt. x–xx (0.65–1.3);
Ol. olivæ,	f ʒj (30.0).—M.

Or,

℞. Ol. pini sylvestr.,	gtt. x–xx (0.65–1.3);
Ol. eucalypti,	gtt. v–x (0.3–0.65);
Alboleni (liquid.),	f ʒj (30.0).—M.

Stimulating action may be increased by adding to the above 1 grain of menthol. This will increase normal secretion, lessen the dryness, and by so doing lessen the tendency to accumulation on the surface and thereby liability of lodgment of bacteria. If the alteration in the tissue be truly chronic, with the formation in the submucosa of new connective-tissue elements leaving permanent thickening, or, from the over-distended vessels in cyanotic conditions, with subsequent atrophic changes in the epithelial and connective-tissue structures, a permanent cure cannot be effected. Should the patient be addicted to the use of tobacco, especially excessive smoking, its use should be prohibited.

Follicular Pharyngitis.

This condition is limited strictly to the pharyngeal mucous membrane and is an involvement of the muciparous glands and surround-

ing lymphatic structure; it occurs more frequently in individuals of a lymphatic temperament and a highly nervous organization. It may occur at almost any age, the most aggravated form occurring in individuals whose occupation requires continued use of the voice, and it is seen in what is called "clergyman's sore throat." Besides the number of small round nodules there are also present in the mucous membrane engorged and over-distended vessels. The treatment should be, first, the careful attention to the general health of the patient, and second, the local treatment of the follicles and engorged vessels. The patient's general condition should be improved by the administration of such tonic agents as the various preparations of iron, nux vomica, cod-liver oil, hypophosphites, etc. The constitutional treatment must depend entirely on the clinical indications presented by the patient, and must be determined by the practitioner. In the early or acute stage where permanent structure-change has not taken place I have obtained excellent results from the administration of drugs which are eliminated by the mucous membrane. The following should be administered three times daily:

℞. Phosphori,	gr. $\frac{1}{100}$ (0.0006);
Iodini,	gr. $\frac{1}{8}$–$\frac{1}{6}$ (0.008–0.001);
Bromini,	gr. $\frac{1}{8}$–$\frac{1}{6}$ (0.008–0.001);
Vini Xerici,	ʒj (4.0).—M.

The distressing cough and constant irritation can be relieved by the administration of codeine, in doses of one-twelfth to one-eighth of a grain, three or four times daily. As to the treatment of the actual follicle, the application of the galvano-cautery should be the last resort, as its use necessitates the destruction not only of the follicle but also some of the healthy surrounding structure, with subsequent fibrous-tissue formation, whilst the contraction is marked when due to burns, and the application of the galvano-cautery practically amounts to a burn. Each follicle may be touched with a 20 per cent. chromic acid solution, or the dilute hydrochloric acid. This can be done without contact to the surrounding structure if a fine-pointed applicator is used on the point of which is tightly wrapped a small portion of absorbent cotton; the cotton is saturated with the solution and the excess dried off with another piece of cotton and then applied directly to the follicle, using very little pressure. In more obstinate cases the simple puncturing of the follicle by means of a sharp-pointed applicator or probe is sufficient. The probe should be bluntly needle-pointed and with no cutting surface. Relief of the engorged vessels may be obtained in the same way. In many cases the above procedure will give permanent relief. Should the condition be chronic with fixed tissue alteration, the appli-

cation of the galvano-cautery is warranted. The needle should be fine-pointed and heated to a white heat and should be applied direct to the follicle, care being taken not to penetrate too deeply into the tissue and not to involve the healthy surrounding structure. I have seen cases in which a great number of follicles have been removed by the galvano-cautery several years previous, in which the condition of the pharynx, brought about by the extensive and possibly careless cauterization, was much worse than that originally produced by the follicular pharyngitis. When follicular pharyngitis is associated with naso-pharyngeal catarrh, treatment for the associated condition should be instituted.

While the excessive use of alcohol and tobacco do not cause follicular pharyngitis, yet they may aggravate the condition and their use should be prohibited.

Dry or Atrophic Pharyngitis (Pharyngitis Sicca).

Dry pharyngitis is usually spoken of as a chronic inflammatory process. It is in reality not an inflammatory process, but a pathological alteration produced in the mucous membrane secondary to such processes, and necessarily involves a number of causative elements. It may follow chronic pharyngitis, either simple or follicular, where, from fibroid-tissue formation in the submucosa, the vascular supply being diminished, there is subsequent atrophy. This contraction involves the submucosa and the muciparous glands, as well as the epithelial layer. Upon the amount of fibrous tissue and the alteration produced in the structure involved in the contraction, as well as the extent of the area involved, will depend the prognosis as to palliation or cure; for, if the process is well advanced, no amount of local or constitutional treatment will alter the already formed fibrous tissue or arrest its contraction. The process may be limited to the pharynx, or it may be subsequent to the same condition pre-existing in the anterior nasal cavity and naso-pharynx; when such is the case, the morbid process involving the true pharyngeal surface is somewhat different and is more amenable to treatment than when secondary to localized inflammatory conditions of the pharynx. This is true for the following reasons: The condition is brought about by mechanical irritation, instead of by spreading by continuity of tissue from the nasal mucous membrane. With atrophy of the mucous membrane of the nasal cavities there is marked enlargement of the space for transmission of air; this allows an increased volume of air to pass through the nasal cavities. Owing to the altered condition of the membrane, even the normal amount of air would not be physiologically altered in temperature and moisture, much less the increased volume. This in itself would act as an irritation to the pharyngeal wall. The cili-

ated epithelium has also lost its function owing to the atrophic process of the nasal mucous membrane; therefore the particles of dust carried in by the air, instead of lodging and being expelled, pass directly into the naso-pharynx and pharynx. Still another source of irritation is the lodgment in the naso-pharynx of the altered secretion, together with its infection by saprophytic bacteria. The fact that such cases are more amenable to treatment does not depend so much upon the structural alteration of the tissue as it does upon the fact that the pre-existing condition in the anterior nares and naso-pharynx directs attention to the pharynx proper, and treatment can be instituted early.

The varieties of dry pharyngitis due to other causes present the same appearance clinically, but differ very much in their structural alteration. For instance, in dry pharyngitis due to certain fumes or vapors the change is limited, at least for some considerable time, to the epithelial layer, and the discontinuance of exposure to such fumes will usually promote a rapid recovery. The variety seen in diabetes mellitus also presents very little structural change and requires no separate treatment other than that indicated in the article on that special disease. A mild variety of dry pharyngitis may be induced by nasal obstruction causing mouth-breathing. The treatment is obvious: remove the nasal obstruction. If this should be done early, before any structural change has taken place in the pharyngeal tissue, the irritated membrane will rapidly return to normal, but should the obstruction be of long standing, the condition of the pharyngeal tissue will be that induced by any chronic inflammatory process. Irrespective of cause the appearance presented by the mucous membrane is the same. The surface is dry and wrinkled and has the appearance of having been coated over with a thin layer of varnish. Localized masses of thick, tenacious secretion of a greenish or brownish color are frequently present; this gives rise to the sensation of a foreign body in the throat, causing cough and continual effort at expulsion.

It has been my own experience that solutions used by the patient rarely cleanse the membrane. While the patient should be given a solution for this purpose to use two or three times daily, to ensure perfect cleansing he should be seen by the attending physician at least every other day, or better daily, and the dried secretion be thoroughly removed, preferably by swabbing the entire surface with hydrogen peroxide and water equal parts, followed by an alkaline wash such as—

℞. Sodii bicarbonatis,
Sodii biboratis,
Sodii chloratis,
Potassii bicarbonatis, *āā.* gr. xv (1.0);
Aquæ, f℥ij (60.0).—M.

This solution should be as hot as can be borne by the patient. The membrane should be thoroughly dried by pledgets of absorbent cotton carefully mopped over the surface and a mild stimulating solution applied. Better results will be obtained by the direct application of such solutions than when applied by sprays. For the local stimulation one-half to one drop of oil of mustard to an ounce of albolene or liquid vaseline, applied every other day directly to the diseased surface, is the best agent. Equally good results can be obtained by using, after cleansing and drying the membrane, pledgets of cotton saturated with an ointment of ichthyol and lanolin equal parts, the pledgets being far back in the nostril from fifteen to thirty minutes or until there is marked stimulation of the membrane.

The object of such applications is to produce merely a hyperæmia of the vessels, and care must be taken not to set up too violent irritation or the resulting inflammatory condition will entirely offset the benefits of stimulation. Even after the most thorough cleansing of the membrane there is a tendency to the rapid accumulation of the altered secretion, and for the relief of the distressing symptoms caused by this accumulation there should be prescribed for the patient an oily preparation which not only lubricates the parts, but also softens the secretion. The following formula will produce the desired effect:

℞. Menthol.,	gr. v–x (0.3–0.65);
Alboleni, vel	
Vaselini (liquid.),	f℥j (30.0).—M.

The menthol is used owing to its slight local anæsthetic properties and for its beneficial stimulation to the circulation, this latter property possibly being the means of producing the anæsthetic effect.

The special constitutional treatment should consist in the administration of drugs which directly affect glandular secretion and are at least partially eliminated by the mucous membranes. In the general treatment, beside such agents as are administered for direct effect on the diseased area, it is well to give some drug that will ensure the regular and free movement of the bowels, not so much by its purgative action as by its stimulation of glandular secretion. For this purpose the phosphate of soda should be given in from 2- to 4-drachm doses in the form of the granular effervescing powder, twice or thrice daily, the frequency and size of the dose depending upon the therapeutic effect and the clinical indications. The iodides, in the form of iodide of potassium and sodium, from their therapeutic action on glandular secretion are unquestionably indicated and beneficial, but as the condition requires their continued use they are generally followed by the gastric irritation which the long-continued use of these drugs produces.

The arsenical preparations, however, are equally efficacious as remedial agents, and owing to their lessened tendency to produce gastric irritation are preferable. The best results will be obtained by the administration of from gr. $\frac{1}{24}$ to gr. $\frac{1}{16}$ of the double sulphide of arsenic given in pill form, three times daily after meals. Besides the special treatment given, appropriate remedies administered for the improvement of the general condition will aid materially in the successful treatment.

Tuberculous Pharyngitis.

Primary tuberculosis of the pharynx alone rarely ever occurs. It is usually subsequent to pulmonary or laryngeal tuberculosis. As to the treatment of the condition, the method is the same whether it be primary or secondary. The prognosis, however, is more favorable in the primary uncomplicated cases than in those associated with pulmonary or laryngeal lesions. The local treatment in any case is directed toward the alleviation of the intense pain and discomfort caused by the ulceration, as, with the exception of possibly an absolutely primary local lesion, a cure can hardly be hoped for. Owing to the fact that the patient's general vitality is much lowered, together with the presence of the specific infective agent, the healing of the ulcer is a slow and almost hopeless process. For the relief of the pain, which is aggravated by swallowing, the local application of a 5 to a 10 per cent. solution of cocaine will suffice. This, however, is only palliative, and from the chronic condition of the ulcer will necessitate the long-continued use of the drug, with the necessarily bad effects, not only locally but also on the general system. I have obtained equally good results, not only for the relief of the local irritation, but also from its cleansing as well as its slightly antiseptic action, by the use of the dilute nitric acid diluted in equal parts of water and applied directly to the ulcerated areas, either by means of an applicator or in spray form. A simple therapeutic agent which gives much relief is the juice of the pineapple, used as a spray or gargle; it is cleansing and acts as a slight astringent, also relieves the irritation and pain.

The treatment by curettement, while it may be a beneficial method, is questionable as a curative measure. For the healthy underlying structure is protected by the limiting membrane, peculiar to the specific inflammatory processes, which prevents spreading other than by continuity of tissue. Now, unless the curettement be thoroughly done and all of the infected area removed, the lymphatic system may be opened and further spreading take place. The most satisfactory plan of treatment is the thorough cleansing of the ulcer with an antiseptic alkaline solution such as—

℞. Sodii biboratis,
Sodii bicarbonatis, āā. gr. x (0.65);
Acidi carbolici, gtt. ij (0.06);
Aquæ, q. s. ad fl℥j (30.0).—M.

The lesion should then be dried and an acid applied. Of the various acids used I have obtained the best results from the use of the dilute nitric or hydrochloric acid. This should be repeated two or three times a day. The application of powders such as iodoform, aristol, etc., is of doubtful value, besides being decidedly disagreeable to the patient. In the early or catarrhal stage the membrane should be cleansed and dried and a mild astringent applied, as tannin, 8 to 10 grains to the ounce; at the same time there should be administered internally carbonate of guaiacol in 1- to 5-grain doses, three times daily. The general condition should be improved, and such constitutional treatment as is recommended in the article on Tuberculosis should be administered.

Syphilitic Pharyngitis.

Of the three stages of syphilis the pharyngeal manifestations are most commonly seen in the secondary and tertiary. The primary lesion is rarely if ever met with in this location. With the recognition of the character of the lesion, internal medication should be instituted; in the secondary stage the mixed treatment, while in the tertiary the iodides alone are much more effective.

The details of the general treatment are too well known to necessitate repetition. Local treatment should consist first of thorough and repeated cleansing of the pharyngeal mucous membrane. This can be accomplished by the patient's repeatedly gargling or spraying the throat with a tepid alkaline wash as given on page 211. This should be followed by a gargle or spray of as hot water as can be comfortably borne by the patient. The areas of ulceration should be touched every other day with nitrate of silver, 20 to 40 grains to the ounce, or carbolic acid, 10 to 20 per cent.; or liquor ferri sesquichloridi, 4 parts; toluol, 36 parts; absolute alcohol, enough to make 100 parts (Löffler's solution). It is understood that the solutions given are not of the strength usually used in similar syphilitic lesions elsewhere, but the object of such strong solutions is to destroy the diseased areas and promote healthy granulation-tissue. Now from the anatomical construction of the soft parts of the pharynx, the mucous surface not being backed up by dense muscular tissue, extensive loss of structure is necessarily followed by fibrous-tissue formation with marked subsequent contraction. The use, therefore, of solutions of sufficient strength to destroy tissue will not only involve the ulcerated area,

but the surrounding structure. Better results, then, will be obtained by thorough cleansing, mild local stimulation, and strict adherence to constitutional treatment, unless the ulceration involves the deeper structure, when the stronger solutions must be used to arrest the invasion. For the relief of the pain, especially during deglutition, a spray of—

℞. Menthol.,	gr. iv (0.25),
Camphoræ,	gr. ij (0.13),
Vaselini (liquid.),	ʒj (30.0).—M.

should be used by the patient, repeated before taking food, or at any other time when the symptoms demand its use. If the ulceration is deep and the pain severe, a 5 to 10 per cent. solution of cocaine should be used. Adhesions involving the soft palate, as well as other deformities produced by the fibrous contraction, which are most marked when following syphilitic ulceration, are now rarely if ever seen; the constitutional treatment having been instituted early in the disease prevents any such extensive local lesion.

Foreign Bodies.

The lodgment of foreign bodies in the pharynx is by no means an uncommon occurrence, and may be due to their size alone, or to both size and shape; spiculæ of bone and fish-bones being particularly liable to lodgment. The common sites are the lower portion of the pharynx, especially for the lodgment of large bodies, the postero-lateral walls involving the palatine fold, and the supra-epiglottic portion of the base of the tongue, which, while not pharynx proper, yet forms a portion of the anterior boundary. Any paralysis or loss of sensibility of the parts will tend to the lodgment of foreign bodies. Occasionally such conditions as follicular pharyngitis or lymphatic enlargement, or scratches produced by the accidental swallowing of such particles as a dry crust of bread, fish-bones, etc., may give rise to sensations and symptoms which simulate those produced by the actual presence of a foreign body and mislead both the patient and physician. To this may be added the imaginary foreign body described by hysterical patients.

The main point in the treatment is the location of the body, the removal after location not being usually attended with much difficulty. The irritation produced by the foreign body should be relieved by the application of an astringent such as tannin, 10 grains to the ounce, or a simple boric-acid wash, 5 to 10 grains to the ounce. This symptom is often so marked that it is difficult to persuade the patient that the foreign body has been actually removed. If much irritation and

laceration has been produced a balsam preparation will relieve by remaining in contact with the tissue for considerable time and forming a protective, as well as by its therapeutic action in exerting its astringent properties. The tincture of benzoin with 50 per cent. boroglyceride, equal parts, will give excellent results. As to the location of the foreign body, the patient should be directed to open the mouth, thus allowing all the parts to be relaxed, and inspection should be made without the use of the tongue-depressor or the laryngeal mirror. The advantage of such examination is that should the source of trouble be a fish-bone or spicule of bone or any small foreign body, the necessary muscular contraction produced by the resistance to the tongue-depressor will hide it in the palatine or faucial folds rendered tense by such contraction; whereas, if these are relaxed, the body will show plainly and can be easily removed. It must also be remembered that any violent contraction will serve to further imbed the foreign body. If from its continued presence there has been produced marked congestion, the location of the body will be still more difficult. If by direct inspection, however, the foreign body cannot be located, the pharyngeal mirror should be used, or, better, after spraying the parts with a 5 to 10 per cent. solution of cocaine, direct examination should be made with the index-finger. By a series of examinations the entire pharyngeal surface can be gone over and the foreign body located.

Foreign bodies in the pharynx are rarely of sufficient size to cause dangerous symptoms, or, if so, from their size permit of easy location and immediate removal; but if the circumstances should be such that immediate removal could not be accomplished and the patient's life be threatened, tracheotomy should be performed at once. If the foreign body be impacted low down in the pharynx involving the supraglottic region, thereby interfering with respiration, the patient should be placed on the table with the shoulders drawn to the edge and the head allowed to hang over. This will allow a direct inspection of the parts, and also aid in the removal of the foreign body, or at least by gravity will free the epiglottis from pressure by the body and lessen the danger of suffocation. Foreign bodies involving the lateral pharyngeal wall may not be imbedded in the tissue, but merely held by the spasm produced by their presence. In such cases relaxation may be produced by spraying the part with a strong solution of cocaine allowing the easy removal of the body without laceration of tissue. In a patient seen by the writer in which a pin was held by spastic contraction of the ary-epiglottic folds, its removal without injury to the parts was accomplished in this way. The patient should be placed in the position described above so that the body when freed will not enter the larynx, but by gravity drop into the buccal cavity.

DISEASES OF THE TONSILS.

UNDER this head we will treat only diseases occurring in the true tonsil. Of the acute inflammations there are many direct and associate causes. However, regardless of cause the acute inflammatory process of the tonsillar structure follows much the same course. If seen early, at the beginning of the inflammatory process, the tonsil should be touched with pure guaiacol, not only over the outer surface, but the crypts should be carefully mopped, being careful lest the guaiacol come in contact with the surrounding structure. This should not be repeated oftener than two or three times daily. Usually one or two applications suffice to abort the attack. If not effectual within twenty-four hours its local application should be discontinued. At the same time there should be given internally drachm-doses of the ammoniated tincture of guaiac in wine or milk and repeated every two hours for from four to six doses. While this treatment will usually give relief, should it fail, then instead of the ammoniated tincture of guaiac there should be substituted the tincture of the chloride of iron, 15 to 30 drops every three hours. The patient should be given at once a purgative, followed by a saline, and if from the character of the onset and symptoms a severe attack is anticipated, he should be put to bed and a 5- to 10-grain Dover's powder administered.

Should the inflammatory condition be well advanced before treatment is instituted, and if the tonsils are swollen and tense, causing difficulty in swallowing, the local treatment should consist in free bleeding by multiple punctures preferably by means of a sharp-pointed probe, as the puncture can be controlled and there is no danger of making too deep or too free an incision, nor of wounding the surrounding structures owing to a sudden movement of the patient. Hot applications externally seem to promote resolution.

The inflammatory process involving the tonsil may be primary, or secondary to peritonsillar inflammation. When secondary the process is in reality quinsy, or beginning peritonsillar abscess. The treatment of either condition is practically the same. There should be applied externally an ointment of ichthyol and lanolin, equal parts. This should be well rubbed in, as the rubbing in itself is beneficial in promoting resolution, and when combined with the action of the ichthyol is highly beneficial. Should the inflammatory process terminate by abscess-formation the pus should be evacuated at once.

When the tonsil is enlarged and of the soft spongy variety, or the tissue œdematous, it is often difficult to make a diagnosis, by inspection and palpation, of pus-formation. This may be done by puncturing the tonsil by means of an aspirating needle, and by suction

determining the absence or presence of pus. Multiple punctures may be made, for even if there is no pus present the free bleeding will be beneficial. The incision for evacuation of pus should be made in the long axis of the tonsil perpendicularly, as a transverse cut will upon healing necessarily form scar-tissue and by contraction may bind down the faucial pillars; while a longitudinal cut will not have such a tendency, or, if so, only to a limited degree. The cutting surface of the knife should be directed toward the faucial cavity, lessening the danger of wounding underlying blood-vessels and thereby avoiding dangerous hæmorrhage. By first puncturing with the needle the cutting of anomalous vessels may be avoided. Generally the pus-formation does not really occur within the tonsil proper, but within the peritonsillar tissue, necessitating a deep incision if it be made through the tonsil. The procedure is often attended with difficulty owing to the fact that the swollen tonsil makes it almost impossible for the patient to open his mouth.

Unquestionably a number of cases of simple tonsillitis are associated with, primarily or secondarily, a rheumatic diathesis. The clinical history of the case should aid in the diagnosis. The local treatment of such cases is the same as given above, but the internal treatment should consist in the administration of such drugs as will promote elimination through the kidneys and intestinal tract. Purgatives followed by salines will relieve the intestinal tract of any engorgement and the kidney may be stimulated by copious draughts of water and by the use of diuretics. This can be accomplished by the administration of Basham's mixture in from 1- to 4-drachm doses repeated every two hours for three or four doses, and then three or four times daily. The salicylates should be given in decided doses, preferably the salicylate of soda, 10 to 20 grains every three hours until three or four doses are given, followed by 5- to 10-grain doses three times daily. Should the salicylates not be well borne by the patient, salol should be substituted, in from 5- to 10-grain doses. There may be combined with the salol small doses of phenacetin, which will afford some amelioration of the pain and will also lessen the irritating effect of the salol on the mucous membranes of the stomach and intestines. The object of the administration of these drugs is to produce as rapidly as possible their complete physiological effect, the obtaining of such effect controlling the repetition and amount of dosage.

Occasionally in a mild attack of tonsillitis following a severe cold from exposure ulcerated areas may form on the tonsils. When this occurs the ulcerated surface should be thoroughly cleansed, dried, and touched with an astringent solution of sufficient strength to cause slight necrosis. This can be accomplished by the application of the

solid stick of nitrate of silver, care being taken not to touch the healthy tissue. After the slough forms, the granulating surface should be frequently cleansed by means of spray or gargle of an alkaline solution such as given on page 211. The process usually terminates by healing without further treatment than the careful and repeated cleansing.

Lacunar Tonsillitis.

This variety of tonsillitis is due entirely to mechanical irritation, produced by a collection of foreign material in the numerous crypts of the tonsil. These crypts vary in size and depth, as well as in location. In them will collect the foreign material, food, etc., which from decomposition and the presence of saprophytic bacteria produces marked irritation. This variety of tonsillitis usually has a history of irregularly repeated attacks without marked constitutional symptoms. The patient usually complains of a feeling of fulness in the throat with the sensation of a foreign body and of a decidedly disagreeable taste, which is easily explained by the decomposing material which has collected in the crypts of the tonsil. The treatment consists in freeing of the crypts of the caseous material. The crypts can usually be located by hard pressure on the tongue, forcing it well down, thus causing gagging on the part of the patient, the muscular contraction forcing the tonsil out and exposing the sebaceous material. This material should be pressed out by means of a strong probe, care being taken to examine the upper portion of the tonsil to see that none of the crypts are occluded by the palatine or faucial folds, causing the retention of the sebaceous material. The tonsils should be then carefully cleansed and after the acute inflammatory processes have subsided the crypts or sacs should be incised either by means of a curved bistoury or the galvano-cautery, the object being to do away with the sac and prevent further accumulation.

Enlarged Tonsils.

Under this heading we have really two conditions. As one variety there is the tonsil enlarged, firm, and dense, the so-called hypertrophied tonsil, which is in reality more of a hyperplasia ; as the other, a soft, boggy, spongy tonsil containing very little connective-tissue element. It must be remembered in the treatment of either condition that the age of the patient and the amount of inconvenience or irritation produced by the enlarged tonsil must be considered. In children and young adults the tonsils are normally large, and unless they give rise to irritating symptoms and interference with phonation, require no treatment. This is equally true in advanced adult life. When the condition is such as to demand treatment, local

applications are of little use in the fibrous or so-called hypertrophic variety. The contour of the tonsil will determine somewhat the treatment. If the surface of the organ be regular, the removal of a small portion by means of the tonsillotome will, owing to the contraction produced by the scar-tissue which necessarily follows, sufficiently reduce its size, the object of this procedure being merely to relieve symptoms without necessitating the removal of the entire tonsil, as its presence is physiological. If the surface is irregular, nodular, and pedunculated, the various projections may be removed by means of the tonsil scissors or tonsillotome.

The after-treatment in either case consists in keeping the parts thoroughly clean by means of antiseptic alkaline solutions. This can be accomplished only to a limited degree, as it is impossible to render the tissues in this location thoroughly antiseptic. For this purpose a wash of biborate and bicarbonate of soda, of each 10 grains to the ounce of water, to which has been added a few drops of carbolic acid, is to be used. In the spongy or adenoid variety local applications are highly beneficial. The surface should be thoroughly cleansed and dried and the entire tonsillar tissue, as well as the crypts, carefully mopped with dilute hydrochloric acid. This treatment continued every other day, together with attention to the individual's general condition, will usually afford relief. There is in some cases, however, a tendency to a recurrence of the condition. If then the application of dilute hydrochloric only gives temporary relief, linear cauterization should be resorted to. The line of cauterization should be made in the long axis of the tonsil, thereby lessening the tendency to involvement of the faucial pillars.

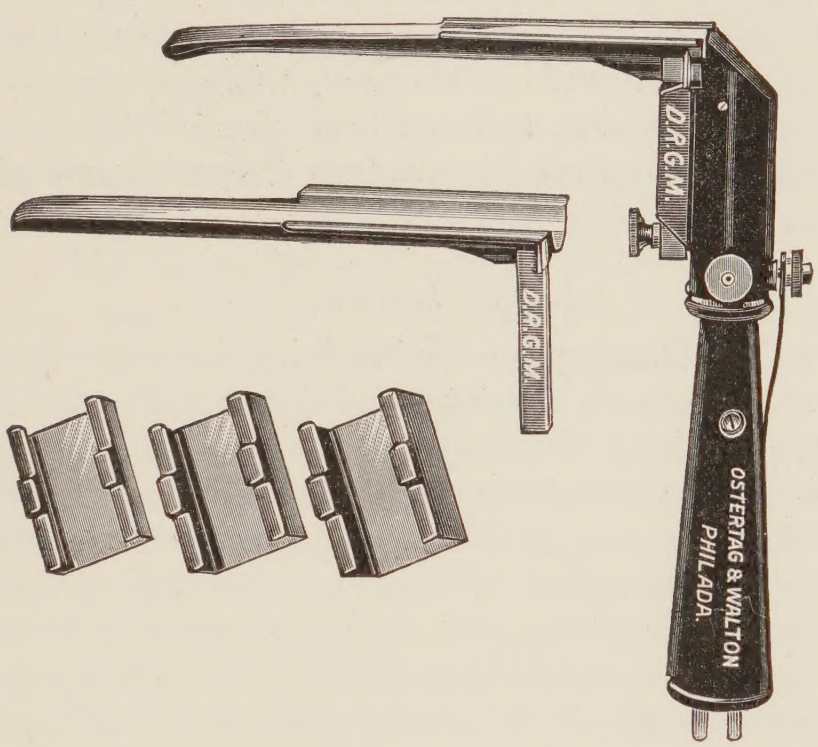
There are exceptional cases in which the tonsils are enormously enlarged, boggy, and filled with crypts presenting a ragged and discharging surface. In such cases a portion of the tonsil should be removed by means of the tonsillotome.

Occasionally cases are met with in which from some acute inflammatory process involving the tonsillar and peritonsillar tissue adhesions have taken place between the faucial pillars and the tonsil, producing, from the contraction which follows such adhesions, a sensation of constriction and discomfort in swallowing, with alteration in the voice. In such cases relief can be obtained by the breaking up of the adhesions and thoroughly freeing the tonsil, without necessitating the removal of the tonsillar tissue.

DISEASES OF THE LARYNX.

Autoscopy.—As supplementing the laryngoscope mirror in the examination of the larynx and trachea, we have the autoscope with the added claims of direct inspection and view of the posterior walls of these important structures. Kirstein of Berlin is the inventor and perfecter of this instrument, which consists of three parts: the spatula, the sliding hood, and the handle. The spatula is a slightly concave metal plate 14 cm. in length, which is in the main straight

FIG. 25.



but is slightly curved downward toward its laryngeal end, where it has a somewhat thickened lip and rounded edges to prevent injury to the parts with which it comes in contact. The sliding hood serves the purpose of keeping the teeth, the lips, and in man the mustache, away from the spatula, leaving sufficient space between the two plates for inspection and for the introduction of any instrument. The handle is the electroscope of Casper, which by means of its small electric light illuminates the entire length of the spatula and the parts beyond. (See Fig. 25.)

The two main conditions upon which the autoscope depends in laryngeal inspection are, first, that firm pressure upon the root of the tongue and the median glosso-epiglottic ligament will elevate the epiglottis, thus giving the desired view; and, second, that by proper position the laryngo-tracheal tube may be made to form a straight instead of an angular line with the axis of the buccal cavity.

The technique of examination is as follows: The physician stands

before the patient, who is seated in a chair with the neck slightly inclined forward. The autoscope is introduced in exactly the same manner as applying an ordinary tongue-depressor. A view of the buccal cavity and oro-pharynx is thus obtained. By pushing the spatula farther backward, elevating the handle, and pressing firmly downward and backward on the base of the tongue, being careful not to use the upper teeth as a fulcrum, the lower part of the pharynx, the larynx, and if the patient's position be correct the trachea, may be seen. The actual tissues appear in autoscopy, not their image, with a remarkable distinctness of anatomical detail. Above all, the posterior wall of the larynx, the interarytenoid fold, which can be examined only with great difficulty by the aid of the mirror, can be inspected almost in a surface view; and the possibility of inspecting the whole of the trachea and the beginning of the bronchi should alone be sufficient to ensure for autoscopy recognition among diagnostic resources.

Acute Laryngitis.

An acute inflammatory process involving the mucous membrane of the larynx is not always a serious condition, yet, from its location and the tendency to œdema with the subsequent interference to respiration, the condition always demands prompt and energetic treatment. By the use of the laryngoscope the area of inflammation can be outlined and its severity determined. If seen early and the process is limited, with no threatened œdema, such remedial agents should be used as will relax peripheral vessels, thereby diminishing local pressure. For this purpose there should be administered internally every hour for three or four doses an effervescing pilocarpine tablet containing $\frac{1}{100}$ grain of the drug. Hot mustard foot-baths should be given, followed by hot drinks, such as hot lemonade, to promote diaphoresis. Attention should be given to the condition of the intestinal tract, and although there is no existing constipation a gentle purgative is beneficial from its general derivative action. This plan of treatment in a majority of cases will relieve the congestion and rapidly promote resolution. If the tissue surrounding the cords be involved in the inflammatory process inhalations of the compound tincture of benzoin, a teaspoonful to a half-pint of boiling water, are useful. If there is marked irritation there may be added to the benzoin a teaspoonful of paregoric. Equally good is the local application by means of spray or nebulizer of some bland oil, as liquid vaseline or albolene, one ounce, to which is added from 4 to 6 drops of oil of sandalwood and one to three drops of oil of tar. If the inflammatory process be in the early stage and the patient's occupation demands the constant use of the voice, relief can be given in a few hours by the administration

of 5 to 10 drops of dilute nitric acid in water or on a lump of sugar, repeated first every half-hour, then every hour, for two or three doses. From its action on the arterioles and relief of the congestion, thereby depleting the part, the condition may be relieved and the voice restored. If this treatment is used in the evening, the morning will usually show a return of the condition, unless the irritation be very much localized, when there is more hope of a permanent recovery.

With regard to the local application of cocaine which is so frequently recommended, while it is unquestionably of value in causing depletion and relieving irritation, yet the local effect is of short duration, thereby necessitating its frequent repetition; the tendency, moreover, to recurrence of the congestion which commonly follows its application renders its use questionable.

The use of external applications affords very little relief. However, early in the inflammatory process the external application of cold by means of the ordinary ice- or cold-water bag may afford some relief. This should be used only early in the case, and should not be applied longer than a few moments at a time, repeated application for a short period affording more relief than the continued application. The insufflation of powders is highly objectionable, as the irritation produced by such agents increases the condition that is sought to be relieved. In the stage of exudation, when there is profuse secretion, before applying the oily solution as recommended above the parts may be sprayed by a simple cleansing alkaline wash such as biborate or bicarbonate of sodium, 10 to 15 grains to the ounce of tepid water. Very little of such application will come in contact with the laryngeal tissue, but it serves to clean away the mucus surrounding the epiglottis and low down in the pharynx.

When there is existing œdema which involves the glottis and laryngeal structure, prompt surgical interference is necessary. The œdematous tissue must be punctured. The puncturing is better than scarifying, as there is less danger of causing any serious hæmorrhage and there is also less laceration of tissue. It must be remembered that in œdema the engorgement is not a vascular one, but a watery infiltration of the perivascular structures, and that such exudation somewhat relieves the engorged vessels. Puncturing, then, will relieve this watery infiltration, while scarifying will accomplish the same result but with the added evil of more extensive laceration. This procedure may be followed by the application of mild astringents such as liquor ferri persulphatis, 5 to 10 drops to the ounce, or argenti nitras, 2 to 5 grains to the ounce.

If the œdema be rapid and well advanced and the danger of suffocation imminent, immediate intubation or tracheotomy is indicated.

There is a tendency after the subsidence of the acute attack to

huskiness or even complete loss of the voice, lasting for several days or weeks. For the relief of such a condition there should be administered internally 5-grain doses of the benzoate of sodium. At the same time there should be used locally mild astringents such as tannin or alum, 5 to 10 grains to the ounce of water, in spray.

General medication is not usually indicated in acute laryngitis, although there may be associated conditions necessitating special attention. For the distressing irritating cough there may be administered an anodyne, as codeine sulphate in doses of gr. $\frac{1}{12}$ to $\frac{1}{8}$, repeated only to the point of relief of the symptom. In individuals of a rheumatic or gouty tendency an alkali should be given. In such cases a 5-grain effervescing citrate of lithium tablet every three hours in half a glass of water, or preferably the carbonate of lithium in the same dose, should be given. If the vocal bands are markedly involved in the inflammatory process, causing complete loss of voice, absolute rest should be insisted upon.

Acute Laryngitis in Children.

Simple acute laryngitis rarely ever occurs in children, the acute inflammatory process either being classed under the spasmodic condition known as spasmodic croup or under the membranous variety of inflammation. While all membranous inflammatory processes are not true diphtheria, yet the symptoms produced by the actual membrane, as well as the early treatment of the case, is precisely the same as in true diphtheria. For the membranous conditions, then, the reader is referred to the article on Diphtheria.

Acute Laryngitis or Spasmodic Croup.—While the anatomical relations of the structure of the larynx in children do not differ materially from those found in the adult, yet the measurements or dimensions are smaller, and there also exists a vascularity of the mucous membrane lining the larynx which is peculiar to children. Any condition bringing about sudden congestion, associated with the narrowness of the rima, will give rise to alarming and distressing symptoms. It must also be remembered that in children reflex excitability is more marked than in adults. That sudden atmospheric changes with exposure to cold and dampness is one of the important exciting etiological factors is borne out by the fact that the condition is most likely to occur in the spring and fall months. Beside these the irritation produced by the inhalation of irritating vapors, fumes, or dust, or an associated gastro-intestinal irritation, may be exciting factors. The condition is sudden in onset, rapid in course, and terminates as rapidly as it began.

As this condition presents no premonitory symptoms, the child usually waking at night with a fully developed case of spasmodic

croup, the treatment should be first directed to the relief of the actual spasm itself, and after this has been relieved the underlying causes should be investigated. Should there be much secretion present and accumulation in the larynx an emetic should be at once given, such as ipecac in the form of the wine or syrup, in a dose determined by the age of the child and the urgency of the symptoms. Prompt emesis can be obtained by the hypodermic administration of apomorphine, but it should only be employed in extreme cases because of its depressing effects. In cases in which there is very little accumulation of fluid within the larynx and yet spasm is brought about reflexly by gastric irritation, an emetic is also useful as a remedial agent. The continued hot bath and the use of hot vapors are successful measures in promoting relaxation and free diaphoresis, and should always be employed. After the relief of the paroxysm attention should be directed toward the exciting factor and treatment directed against its return. Any gastro-intestinal irritation should be corrected, and the child should be kept in an equable temperature and care should be taken that the air of the room be of the proper humidity and that it be free from any irritating fumes such as are generated by improperly regulated heaters or the ordinary coal-stove.

Subacute Laryngitis.

This condition is usually secondary to the acute. The conditions vary much in individual cases and the successful treatment will depend on a thorough knowledge and close study of the causes underlying each case. The thickened inflammatory condition involves the submucosa with infiltration into the perivascular structure. This condition continued produces perverted secretion with annoying dryness and distressing hoarseness. Should there be any irritating or exciting causes, such as smoking, inhalations of dust, etc., the removal of these exciting factors is the first thing to be done in the treatment of the case. The local application should consist of an alkaline spray, which should be as hot as can be comfortably borne by the patient. Warm boric-acid solution, 5 to 15 grains to the ounce, is highly beneficial, although the benefit derived by the application of the warm water alone is to my mind quite as great as when the acid has been added. This should be repeated six to eight times daily, but if the condition exists in an individual whose profession necessitates the use of the voice, the warm spray should not be used within three or four hours of the time of the continued employment of the voice. As far as possible, though, in individuals suffering from this condition, rest of the vocal bands—at least from any continued effort—should be insisted upon.

In individuals in whom the dryness is due to a deficiency of secretion the internal administration of drugs which increase secretion will

produce the best results. However, it must be carefully ascertained that there is no lesion elsewhere which is the direct cause of the laryngeal complication. For example, such conditions as valvular heart disease or fibroid lung, or any lesion of the circulation with a tendency to cyanosis of the mucous membrane, will bring about just such a condition of dryness in the larynx. If such condition exist, local or internal medication directed to the laryngeal structure alone will be of little value. For the increase of secretion in such cases as are not dependent on the causes mentioned above there should be administered internally, every three hours, 5-grain doses of the benzoate of ammonium to be given in half a glass of water; its irritating effect on the mucous membrane of the stomach can be avoided by discontinuing its use every third day. In cases where the drug is to be used for a long time this omitting of the dose every third day should be part of the directions for its use. If the condition is well advanced and bordering on a chronic laryngitis, better results will be obtained by the administration three times daily of 5 grains each of iodide of sodium and potassium, observing the same precaution as advised in the use of the ammonium salt.

In the subacute variety following a catarrhal process, in which the hoarseness in speaking is produced by the accumulation of secretion about the vocal bands and within the larynx, the best results will be obtained by the internal administration of 1- to 3-grain doses of carbonate of guaiacol in pill form in plenty of water. This seems to relieve the condition by thinning the viscid secretion and by its stimulating action on the muciparous glands and circulation. By such action the parts are relieved of the irritating secretion, and normal circulation and secretion are established. In cases in which the secretion is exceedingly tenacious, before the guaiacol is given or in combination with it there should be administered terpene hydrate in 5- to 15-grain doses; any irritating effect of this drug on the mucous membrane of the stomach can be avoided by giving it in a large amount of water. This should be taken every three hours until there is marked effect on the secretion, and then two or three times daily. Should this excess of secretion, although of a fairly normal character, be continued the administration of the above drugs should be discontinued and there should be given three or four times daily gr. $\frac{1}{24}$ of morphine, or, better, gr. $\frac{1}{12}$ of codeine.

In all cases of laryngitis, either acute, subacute, or chronic, attention should be devoted to the gastro-intestinal tract, and such conditions as tend to cause deficiency in glandular secretion and venous stasis should be relieved. One of the best agents for the depletion of the intestinal circulation and for its derivative action on laryngeal structures is sulphate of magnesium in large doses. It must be

remembered that frequently acute or subacute laryngitis is caused by the spreading of the inflammatory process by contiguity and continuity from some neighboring structure or part, as from the pharynx, œsophagus, tonsils, and naso-pharynx. In such cases the active treatment should be directed toward the offending structure as well as the medication of the larynx itself.

Inhalations if properly administered are of some benefit. A teaspoonful of the tincture of benzoin placed in a cup of boiling water and the medicated steam inhaled just before retiring will often relieve the distressing cough and irritation so often increased when the recumbent position is assumed. Inhalations should not be used, however, except when the individual is confined to his room or just before retiring, as otherwise there is danger of catching cold.

Local applications made directly to the larynx are of questionable value; for the laryngeal structure is physiologically opposed to and anatomically protected from the entrance of foreign bodies. The introduction of the applicator is practically that of a foreign body, and the irritation produced by the immediate application of remedial agents to the sensitive laryngeal structures will more than counterbalance the beneficial effect aimed at.

Chronic Laryngitis.

Of the chronic inflammatory processes involving the laryngeal structures in addition to the chronic specific inflammations there are two principal ones: first, simple chronic laryngitis; secondly, dry laryngitis or laryngitis sicca.

Simple Chronic Laryngitis.—Simple chronic laryngitis may be secondary to an acute condition of the larynx, but the process is usually secondary to or associated with lesions of the respiratory tract above the larynx, and the treatment should be primarily at least directed to the relief of the existing lesions rather than directly to larynx itself. In all catarrhal conditions of the nose, naso-pharynx, and pharynx, with the consequent accumulation and irritation produced by such accumulation there must necessarily be produced continued irritation of the laryngeal structure. Repeated and thorough cleansing of such affected parts should be strictly enforced. For its cleansing and detergent effect bicarbonate of potassium and bicarbonate of sodium, of each 10 to 15 grains to the ounce of warm water, three or four times daily, as a douche or by means of a spray, should be used.

For the treatment of the catarrhal condition after cleansing there should be applied directly to the structures a mild astringent. For this purpose a solution of sulphate of copper or nitrate of silver, 5 to 10 grains to the ounce, may be employed and intra-laryngeal

applications made. When applied by means of cotton, care should be taken that no excess of the solution be used, as the pressure employed in the application may cause the solution to run over healthy structures and down into the trachea. Equally good results will be obtained by the application by means of a spray of a 3 per cent. solution of alumnol; although a comparatively new drug, I have found it highly beneficial in such conditions. The employment of astringents is often overdone, and applications should not be made oftener than once daily.

Besides the correction of any nasal irregularities, attention must be given to the individual's personal habits as regards the use of tobacco and alcohol. As climate and occupation may have to do with the case as etiological factors, temporary or possibly permanent change from such exposure should be insisted upon. It must be remembered that the condition may be dependent upon or aggravated by gastro-intestinal, hepatic, and even renal lesions. In such cases treatment should be directed toward the offending organ. If the general health is at fault, constitutional treatment should be instituted. Of the therapeutic agents administered for the direct effect on the mucous membrane, if the secretions are profuse yet tenacious, benzoate of sodium three or four times daily in 5-grain doses is the best. If the secretions are scanty and there is a tendency to dryness of the membrane, iodine gr. $\frac{1}{8}$, phosphorus gr. $\frac{1}{100}$, bromine gr. $\frac{1}{8}$, in sherry wine (compound wine of iodine), in plenty of water three times daily, is useful.

Dry Laryngitis or Laryngitis Sicca.—Dry laryngitis is always a chronic condition in which there is not only a deficiency of secretion, but the secretion present is not of a normal character and there is a marked tendency to the rapid coagulation or drying of this material on the surface of the mucous membrane. While the condition is analogous to atrophic rhinitis, yet it is questionable if it is dependent upon or other than accidentally associated with it. Whether it be brought about by a chronic inflammatory process with involvement of the submucosa, with connective-tissue proliferation and new tissue formation and subsequent contraction, or whether it be primarily some atrophic process involving the mucous membrane, it matters little, as either condition would bring about interference with the function of the muciparous glands normally located in the laryngeal structure. Personally I do not believe that the atrophic process is brought about by any one particular condition, but that it may be produced by a number of pathological alterations. For example, in a cyanotic condition with continued pressure caused by engorged vessels, with the necessary entanglement of the muciparous glands, the same condition would be produced as when the gland-structure is involved and the contracting tissue is the result of a chronic inflammatory process.

The treatment of this troublesome condition should be directed first toward the removal of the associated lesions. The general health of the individual must, then, be carefully looked into and tonic agents should be administered, as the general condition of the patient indicates. Abnormalities in the nasal cavities and naso-pharynx should be corrected. For the relief of the irritation caused by the accumulation of the dried material within the laryngeal structures direct medication is necessitated. There should be applied directly to the surface, by means of spray or applicator, a dissolving, cleansing alkaline solution such as already recommended. The irritation of the membrane by the introduction of the applicator will be productive of no harmful results; in this condition a slight irritation is really beneficial. After the removal of the inspissated mucus the parts should be lubricated with a bland oily solution such as liquid albolene or benzoinol to which has been added six drops of the oil of sandalwood to the ounce. This solution applied at intervals of three or four hours will relieve the patient of the distressing symptoms produced by the drying of the secretion.

As to internal administration, the phosphorus, iodine, and bromine combination mentioned on page 228 is very beneficial. However, if the condition is well advanced and permanent alterations have been produced in the mucous membrane, nothing but palliation will be accomplished, as a permanent cure cannot be effected.

Œdema of the Larynx.

Œdema of the larynx may be produced in a number of ways. It may be associated with an acute laryngitis, may be a result of inflammatory processes involving the pharyngeal, tonsillar, or peritonsillar structure, or may be produced suddenly by the inhalation of acrid vapors or irritating fumes. Such processes will produce an acute condition, yet it must be remembered that chronic specific inflammations also may bring about a sudden œdema of the larynx—as, for example, in syphilis and tuberculosis, in which the blood-vessels are involved and there is an œdematous infiltration of the adjacent structures. This is also true in malignant diseases of the larynx. The irritation caused by foreign bodies not within the larynx, but in the œsophagus or the pharyngeal structure, may produce a sudden œdema of the larynx. The treatment should first be directed toward the relief of the œdema, whether it be due to an acute phlegmonous inflammation, passive congestion, irritation from foreign bodies, or irritating vapors, and then the curative treatment or the treatment to prevent its recurrence should be addressed to the underlying cause.

Besides the irritation caused by disease processes in the structures

immediately adjacent, it must be remembered that œdema of the larynx may be caused by cardiac and pulmonary conditions producing cyanosis of the mucous membrane, also that renal and hepatic lesions, especially the fibrous changes, through their action on the heart, may bring about the same condition. In all such cases the constitutional treatment should be directed toward the offending structure, to prevent, if possible, a recurrent attack.

For the immediate relief of the œdema puncturing or scarifying should be done at once ; the patient should be given a saline cathartic and kept in a warm room in an atmosphere thoroughly surcharged with moisture, and a diaphoretic administered. The punctures and scarifying should be done under the same rules as mentioned under Acute Laryngitis with subsequent œdema. The application of astringents after puncturing are rarely necessary if the above method has been carried out. However, should it be necessary to apply astringents, 10 grains to the ounce of nitrate of silver, or a 10 per cent. alumnol solution, should be used. As a rule, if the puncturing be followed by the application of a 20 to 30 per cent. aqueous solution of ichthyol, the tendency to recurrence is markedly diminished, as the ichthyol promotes rapid resolution. In all cases of œdema associated with renal, cardiac, or hepatic disorders free daily movements of the bowels must be secured until the condition is relieved. The application of cold in the form of ice-bag, or Leiter's coils, or the application of leeches may be of service in arresting further œdema, as the effect produced by such procedure is largely limited to the blood-vessel itself, while the condition to be relieved is entirely a perivascular one and consists of a watery infiltration of the structures involved. Such procedure then would be of service only by toning up the vessel-walls and in this way preventing further leakage, but would not affect the serum already poured out into the perivascular tissue.

In cases of sudden œdema which are usually associated with acute suppurative processes, it may be so sudden and rapid that the patient is in danger of suffocation. In these instances intubation or tracheotomy should be performed at once. Tracheotomy is preferable to laryngotomy only because the opening in the air-passages is at a point away from the inflammatory process. In œdema of the larynx associated with syphilitic lesions it must be remembered that the administration of the iodide of potassium, while not actually producing the condition, tends to complicate and aggravate it and should be discontinued.

Œdema may be associated with either perichondritis or chondritis as causative factors, and when the diagnosis is assured the treatment should consist, early in the condition, first, in the application

of the aqueous solution of ichthyol internally, externally an ointment of ichthyol and lanolin equal parts. Should the œdema be threatening and require immediate relief it will be necessary to resort to scarification and puncture. Involvement of the cartilage or pericartilaginous structures is rarely associated with simple acute inflammatory processes, but usually with infectious diseases, frequently following typhoid fever.

Specific Inflammations.

Under the specific inflammations the varieties which we commonly have to deal with in the laryngeal structure are syphilis and tuberculosis, although glanders may also occur.

Glanders of the Larynx.—This is a rare condition and is never limited to the laryngeal structure, and when such involvement takes place it is in the chronic form. One case was seen by the writer in which this condition involved not only the pharyngeal and nasopharyngeal but also the laryngeal structure. The diagnosis of such a condition can be established by bacteriological investigation, and unless made early complete removal is almost impossible. Outside of surgical interference the administration of iodide of potassium pushed to its physiological limit will be of benefit. The treatment with melanin may be productive of good results, but not sufficient experience has been reported to warrant its recommendation as a curative measure.

Tuberculosis of the Larynx.—Tuberculosis of the larynx usually occurs secondary to pulmonary tuberculosis, although primary involvement of this part may occur. The treatment in either case is the same, although the prognosis in the primary condition is more favorable than when dependent upon pulmonary lesion. Much can be done by regular systematic local treatment to retard the progress of the disease, and possibly in some cases a cure may be effected. As a rule, the condition when presented for treatment has advanced to ulceration. Repeated and thorough cleansing of the part should be instituted at once. This can best be accomplished by spraying the parts with hydrogen peroxide (15-volume), followed by an alkaline antiseptic solution such as biborate and bicarbonate of sodium, of each 10 grains to the ounce of cinnamon-water and distilled water equal parts. After cleansing and drying, the ulcerated surface should be carefully touched with dilute nitric or hydrochloric acid. The frequency of such applications must be left to the judgment of the physician based on his knowledge of the case, but as a rule once daily is sufficient. If the ulcer is deep, curettement under cocaine or eucaine anæsthesia should be done. The curettement should be thorough, as it must be remembered that the tubercular area is sur-

rounded by a limiting membrane, and unless the infected tissue be thoroughly removed the breaking up of the protecting membrane may be the means of rapid dissemination of the tuberculous infection through the lymphatics or blood-channels. In cases in which the ulceration is not far advanced, or the process is somewhat limited, after the cleansing and drying of the surface there should be applied directly to the ulcerated area, either by means of spray or applicator—

℞. Creasoti,	ʒj (4.0);
Olei picis liquidæ,	gtt. xx (1.3);
Alboleni (liquid.),	f ʒss (15.0)—M.

Castor oil may be substituted for the albolene on account of its viscid and tenacious properties, but I find it productive of no better results.

The most distressing symptom experienced by the patient is the constant pain, which is especially aggravated by swallowing. A number of agents are recommended for the relief of this condition, no single remedy being efficacious in all cases. The simplest and the one from which I have obtained the best results is the juice of the ordinary pineapple applied by means of spray or applicator. This can be frequently repeated without any ill effects. Cocaine in a 6 to 10 per cent. solution as a spray will give relief, but it is not lasting and requires frequent repetition. Inhalation of benzoin gives partial relief. Should there be dryness of the parts, a solution of—

℞. Menthol,	gr. iv (0.25);
Olei santali,	gtt. iv (0.25);
Alboleni (vel benzoinol),	f ʒj (30.0).—M.

will lubricate the surface and relieve the irritation. Cracked ice acts favorably and gives some temporary relief. Liquid diet should be instituted and no irritating condiments used. In the advanced stage of the disease in which the treatment is purely palliative, narcotics may have to be administered to relieve the intense suffering.

The constitutional treatment should consist in the administration of such drugs as will improve the general nutrition, as cod-liver oil, iron, hypophosphites, or the arsenical preparations, and if the tubercular tendency be recognized early, the patient should be placed under suitable climatic conditions.

Syphilis of the Larynx.—Under this heading is included all conditions brought about by the inoculation of the specific virus either hereditary or acquired. The diseased condition of the larynx is usually manifested in the secondary or tertiary form. Primary lesions

rarely, if ever, occur in the laryngeal structure. The laryngitis of secondary syphilis presents very little that is characteristic, the common lesion being the tertiary one. The primary lesion presents no indication for treatment; the better rule is to follow the well-established practice of waiting for secondary manifestations. The mucous patch which occurs in the larynx is usually limited and single and yields promptly to internal medication. If, however, local treatment should be indicated the lesion is treated exactly as a mucous patch elsewhere. In the superficial ulcer the parts should be thoroughly cleansed, following the same method as given under tuberculous lesion of the larynx, and then touched with 20 to 40 grains of nitrate of silver to the ounce of water. Good results may be obtained, when the ulcer is accompanied by an acute inflammatory process involving the surrounding tissue, by insufflation, after thorough cleansing, of pyoktanin (1 to 2 drachms to the ounce of stearate of zinc). The objection to the use of powders is the danger of drawing the powder farther into the respiratory tract and producing irritation. This can be obviated by the patient taking a deep inspiration and holding the breath during the insufflation. By so doing the first respiratory act after the application will be one of expiration.

In the deep ulceration due to gummatous degeneration the same course of local procedure as followed in the secondary lesions should be observed. In the secondary and tertiary stages, while the local treatment is of importance, yet the internal medication is the prime factor, and the system must as soon as possible be brought completely under anti-syphilitic influence. In the second stage the mixed treatment is to be used; the iodide of potassium alone in the tertiary lesion. The plans for such treatment are too well known to necessitate repetition. (See article on Syphilis.)

Much has been written in regard to the treatment of syphilitic stenosis due to fibrous-tissue formation after ulceration. This should not occur if, upon early recognition of the lesion, proper, prompt, and energetic anti-syphilitic treatment has been instituted, and it is only in neglected or exceptional cases that such lesions exist. Once fibrous-tissue formation has taken place no amount of internal medication will benefit it. The resulting cicatricial tissue presents the well-known stellate scar with the peculiar contraction and alteration of the contour of the part. The division of the stellate bands may relieve somewhat the condition, but the incision that divides the bands brings about another inflammation with its subsequent contraction. Various dilators are recommended, and no doubt produce some beneficial results, but it must be remembered that we are dealing with an inflammatory fibrous tissue, and while dilatation may retard and somewhat arrest the contraction it cannot entirely remove the stenosis.

The contraction may go on to such an extent as to necessitate, in order to prolong the patient's life, the performing of tracheotomy.

Tumors of the Larynx.

Owing to the histological structure of the larynx it is possible to have occurring there any variety of tumor, either adult or embryonic, of either type of tissue—epithelial or connective. The benign or adult tumors occurring within the larynx or involving the vocal bands are always of grave import, not only from the irritation produced by the presence of such a tumor—which in itself acts very much the same as that of a foreign body, interfering with phonation and respiration, such interference depending upon the size and location of the tumor—but also from their tendency to malignant change. It is a well-known clinical fact that benign neoplasms which are subject to chronic irritation or trauma may become the site of malignant growths. This does not mean that the benign growth is by some unexplainable process transformed into a malignant one, but that the former is the site of the malignant development just as any other adult structure may be the site of such development. Of the adult tumors occurring within the larynx or involving the cords the papilloma is possibly the most frequent. This is an adult epithelial neoplasm, and contains both connective and epithelial types of tissue. From the chronic irritation, then, this simple benign tumor may be transformed into a malignant or carcinomatous growth. Of the adult connective-tissue tumors likely to occur in this location the simple myxoma or the fibro-myxoma are the most common.

The attempt at removal of such tumors by the application of acids or other irritants may bring about malignant change. As by trauma, and the application of such solutions as chromic acid, or the galvano-cautery which practically amounts to trauma, this benign connective-tissue tumor may become the site of a malignant or embryonic connective-tissue growth—sarcoma. The treatment, then, of benign tumors involving the laryngeal structure should be their prompt removal through surgical interference, either by cutting forceps, cold snare, or especially curved scissors, care being taken to produce as little laceration of the healthy structure as possible and yet obtain the complete removal of the growth. Malignant growths will necessitate a major operation such as the removal of a portion or the entire laryngeal structure. This has been successfully done, and the individuals were for a time at least freed from any manifestation of the growth. At the same time, owing to the rich lymphatic supply, there is quite likely to be a return of the tumor, or rather, often, a failure of complete removal. As all varieties of the carcinoma spread by the lymphatics, no fixed or definite line can be drawn as to limit of the inva-

sion. Sarcoma occurring in this region is equally liable to dissemination, although through the blood-channels and not by the lymphatics. In either case with the invasion of the surrounding structure its complete removal would necessarily involve the important and vital structures of this region. Partial removal, then, may afford some temporary relief, but a permanent cure cannot be expected.

Foreign Bodies in the Larynx.

The introduction into the larynx or the trachea of a foreign body is an accident at once alarming and at the same time exceptionally dangerous to life. Foreign bodies interfere with respiration in several ways: first, by size; second, by size and shape combined; third, by their composition—for certain substances, as wood, cork, grains of corn, etc., owing to the absorption of moisture increase in size after introduction, thus causing obstruction and increasing the tendency to œdema, either in the larynx primarily, or secondarily from adjacent structures or the œsophagus by being lodged in those structures. The commonest mode of entrance is through the mouth during ill-timed or forcible inspiration, either while laughing, eating, or upon being suddenly startled or frightened. Whether the body be caught in the larynx or swept immediately and directly into the trachea or bronchi depends upon its size and shape. Large and irregularly shaped articles being unable to pass through, are caught and held in some part of the larynx.

The history of the case often leaves no room for doubt as to diagnosis. But should any exist, the direct inspection by the use of the laryngeal mirror (after overcoming spasm, if it exist, by a 10 per cent. cocaine solution), digital examination, or auscultation will soon reveal the location of the offending article.

Another and recent method of determining the exact position of the foreign body encysted or free in the upper respiratory tract is the discovery of Professor Roentgen. Not only photography using the Roentgen rays, but also the cryptoscope with the fluorescent screen has proved eminently satisfactory, not only in the locating of foreign bodies, but also in determining alteration in the bony and cartilaginous structure such as necrosis of bone and ossification in the cartilages. The transparency to the rays of the cartilaginous matter of the larynx, however, renders it necessary to draw up a projected chart of this region for the localizing with exactitude of the actual position of the foreign body. The pain due to a foreign body is often referred to a point other than its actual location. By determining its exact position by the *x*-rays, the false data of this misleading symptom can be at once set aside.

In a number of cases the foreign body has been spontaneously

expelled through the mouth; should this not occur, however, an effort should be made at once to extract it through the natural passages. The special means and instruments to be employed to accomplish this end differ with each case, but the position to be assumed by the patient while the effort is made to extract the foreign body is identical in all cases. He should lie on his back on a table with the shoulders at the edge, the head hanging over, with the mouth wide open. By the adoption of this position—1. The physician is enabled to examine the patient with at least as much ease as in any other posture, with the added value of better control of his movements; 2. Respiration is not interfered with; 3. The foreign body if it be detached, whether by efforts of the examiner or spontaneously, cannot drop farther into the respiratory tract, but must of necessity fall into the mouth.

Sternutatories, emetics, and the like may be of value and should be administered. Should necessity require it, the respiratory tract should be opened in the position most favorable for the removal of the body. Intubation if attempted should be done with exceeding caution, as there is great danger of further imbedding or pushing the body down into the bronchi. Usually the symptoms produced are so sudden and of such a threatening nature as to demand immediate relief, so that often the many convenient and useful instruments devised for the removal of foreign bodies are not at hand. The multiplicity of instruments devised proves that no single one is applicable in all cases. A simple improvised instrument is the wire loop, using several loops and passing them well down into the larynx, and by twisting the wires on removal the foreign body may become entangled in the coils.

The foreign body may be impacted and retained by muscular spasm, especially if above the true bands. If the patient be placed in the position given above and the parts sprayed with a 20 per cent. solution of cocaine, relaxation may be accomplished and the body drop out by gravity. Smooth and metallic bodies may be expelled by inversion of the patient.

NEW FACTS AND METHODS IN THE TREATMENT OF DIPHTHERIA.

By WILLIAM HALLOCK PARK, M. D.

In the treatment of diphtheria we have at last a specific remedy. I believe it is no exaggeration to say that in *diphtheria antitoxin* we have a remedy superior to all other remedies combined. It has both immunizing and curative properties, and in no wise interferes with other treatment.

Through our investigations upon the pathology and bacteriology of diphtheria we have gained more correct views upon local and general treatment. By means of cultures we can determine the presence or absence of diphtheria bacilli in the throats of convalescent patients and also of those who have been in contact with the sick. We are thus able to shorten or lengthen the isolation of each case according to its individual need.

In *anti-streptococcus* serum we have an attempt to combat the invasion of the streptococci, so that we may not only be able to cure cases of pure diphtheria, but those in which the lesions are due to mixed infection. This serum is as yet very weak in curative power, but it may at any time become sufficiently improved to have practical value.

No new drugs or methods of operation have been brought forward that seem to me to possess any value superior to those already long in use.

Diphtheria Antitoxin.

Origin.—Experiments have shown that the blood of persons who have recovered from an attack of diphtheria contains a substance which is an antidote to the poison produced by the diphtheria bacillus. It has also been shown that the blood of animals which have received repeated injections of the diphtheria toxin contains this same curative or antitoxic substance, and in even greater amounts. At the present time horses are universally used to obtain this serum. Healthy young horses are injected subcutaneously for several months with ever-increasing doses of the diphtheria toxin. After periods varying in different horses

the blood is found to contain sufficient antitoxin to be used for purposes of treatment. The blood is drawn aseptically by tapping the jugular vein and collecting it in large sterilized flasks. Here it is allowed to clot and the serum to separate. The latter is drawn off under aseptic precautions and bottled for use, preservative such as a little camphor or carbolic acid being added. The serum is tested upon guinea-pigs and is measured in antitoxin units. An antitoxin unit is an amount of antitoxin sufficient to save the life of a guinea-pig from an injection ten times the fatal dose of diphtheria toxin, the two being injected together.

At first serum was used which contained but 50 to 100 antitoxin units in each cubic centimetre, but now much stronger serums have been obtained, and it is better to employ one containing at least 200 units in each c.cm., and, better still, one containing 500 units.

Curative and Immunizing Value of Antitoxin in Animals.—As guinea-pigs and other animals are very susceptible to diphtheria, our observation of the effects of antitoxin in them has been of great practical value. A dose of antitoxin given to animals before or at the same time as a dose of diphtheria toxin or of the living diphtheria bacilli will always and invariably prevent the poisonous effects of the toxin or bacilli.

If the inoculation with the antitoxin follows within a short time that of the poison or living germs, it will in greater amounts still prove curative, but if the antitoxin is withheld until the animal is under profound constitutional poisoning, the antitoxin without regard to dose will prove valueless. The above facts have proven to be universally true in countless experiments, and in the strongest way indicate the danger of delay in using antitoxin. The cells seem capable of being affected by but one of the two substances. If healthy, the antitoxin so alters them that the toxin is powerless to exert its otherwise deleterious effects, while if injured materially by the toxin, the antitoxin can no longer exert its protective influence, the lesions advancing in spite of it.

In animals also it has been shown that a definite amount of antitoxin is required to neutralize a definite amount of toxin. If the toxin is doubled, the antitoxin must also be doubled. It has also been shown that a sufficient amount is as good as an excess.

Use of Antitoxin in Human Beings both in Treatment and as an Immunizing Agent.—To the teachings of animal experimentation we have now added the experience gained from the treatment of many thousands of cases, over 50,000 having already been recorded.

Although I believe that the curative value of diphtheria antitoxin is absolutely established, yet because its use is so recent, and also

because it has still a few opponents, I shall give not only my personal views and experience, but also that of others.

Before doing this it will be well to consider briefly a few facts concerning diphtheria and diphtheria antitoxin, a correct understanding of which is absolutely essential to our forming a true estimate of the curative serum.

Diphtheria starts as a local lesion, and the toxin is produced by the bacilli at the site of the membrane; as the epithelium becomes necrotic absorption takes place and general constitutional symptoms and lesions develop. In some cases the absorption is very rapid, in others it is slow. The amount absorbed also varies. The hour and day upon which the absorbed poison has produced such an effect upon the cells of the body as to prevent antitoxin producing its immunizing effect must vary in every case. In stating that a case was injected upon the first or second or any other given day, we therefore only in the roughest manner indicate the condition of the patient.

The local lesions in diphtheria indicate only in a general way the amount of poison which is being absorbed and the susceptibility of the patient: we can therefore only estimate roughly the amount of antitoxin required to neutralize the poison.

Another most important fact to clearly recognize is that while diphtheria antitoxin only neutralizes the effect of the poisons produced by the diphtheria bacilli, diphtheria itself is frequently a disease due to mixed infection.

The lesions of diphtheria in the pharyngeal type are usually at first due mainly to the diphtheria bacilli, but in the laryngeal cases the frequently complicating bronchitis and pneumonia are due fully as much to streptococci and pneumococci as to diphtheria bacilli. Upon the poisons produced by these cocci the serum has no effect.

Antitoxic Serum.—The serum should be derived from horses, should be clear, and have little or no sediment. It should have no odor other than that of the preservative used. It should be obtained from a reliable source and contain from 200 to 500 units in each cubic centimetre.

The serums which tests have shown to be reliable are those furnished by Parke, Davis and Company, Aronson, Roux, Health Department of New York City, Mulford, and Behring. Many city boards of health, such as Philadelphia, Boston, and Brooklyn, furnish a reliable preparation for free distribution in their respective cities.

Dosage.—This is governed by the size of the patient, the extent and duration of the disease. The serum is injected hypodermically in the subcutaneous tissues of the side of the chest, lumbar region, or elsewhere.

Immunization.—For children under a year 50 to 100 units, for

larger children 200 to 300, and for adults 400 to 500. This will be, of a high-grade serum, from 3 to 15 minims.

TREATMENT.—The present tendency is rather in the direction of giving larger doses than formerly. Some believe in giving all the serum in one dose, others in several injections.

The serum sometimes produces some slight shock when given in large amounts. This is avoided by dividing the dose. On the other hand, it is contended that in obtaining the full antitoxic effect at once the good obtained more than counterbalances the, as a rule, slight deleterious effects.

My own opinion as to dosage is as follows: For young children with mild throat-diphtheria a single dose of 1000 to 1500 units. If the symptoms do not abate, a second injection to be given in twelve to eighteen hours. For young children with laryngeal diphtheria or with severe nasal or pharyngeal diphtheria an injection of from 2000 to 2500 units should be given, followed by a second injection of the same size twelve to eighteen hours later. In adults the amount should be about one-half larger for cases of equal severity.

The antitoxin serum after being injected into the tissues is allowed to be gradually absorbed without the aid of rubbing.

THE USE OF DIPHTHERIA ANTITOXIN IN PREVENTING BY IMMUNIZATION THE DEVELOPMENT OF DIPHTHERIA.—The use of antitoxin in immunization is not less important than in treatment. An injection of from 100 to 400 units, according to the age of the individual, practically ensures him from an attack of diphtheria for at least four weeks. It prevents the necessity of sending children away from an infected household, and allows us to stamp out epidemics from schools and asylums.

At the time of the introduction of antitoxin there were a number of children's asylums in which diphtheria was epidemic. This furnished an unique opportunity to demonstrate the prospective value of antitoxin. It is practically impossible to state whether any given exposed person will or will not develop diphtheria, and thus it is open to doubt whether in any given case the immunity was natural or was acquired by the injection; but the case of asylums, where cases were developing every day, it was a certainty that cases would continue to develop. If in each of these all cases ceased upon the day upon which antitoxin was injected, it could be considered as proven that this sudden stopping of the outbreak was due to the protective power of the antitoxin. If, still further, some of those not injected developed diphtheria, the proof would be all the more certain.

These encouraging results have been obtained in the children's asylums and in the crowded tenements of New York. They encourage the hope that a general use of antitoxin for immunization will to a large

extent limit the spread of diphtheria. At the Mt. Vernon branch of the New York Infant Asylum a case of diphtheria developed on February 18, 1894. Cases continued to develop from time to time, so that in September alone 14 cases occurred. From that time until January 14th there was hardly a day in which a case did not develop. On January 16th and 17th 221 children were each injected with from 100 to 200 units of von Behring's serum. No bad effects were seen, and during the next month but 1 case of diphtheria developed; this was on the fourteenth day. From February 22d to 27th 5 cases appeared, and the children were again immunized. This time they each received from 125 to 225 units of von Behring's standard of a serum prepared under the direction of the New York City Health Department.

No cases appeared after the second immunization for a period of five weeks. Cultures made from the throats of those in the neighborhood of this case showed diphtheria bacilli in the throats of 6 of the children. These 6 were given 200 units each on March 30th. One of these children developed a small patch two weeks later, but had no constitutional symptoms. A case developed on May 3d, and one on May 27th, in the children immunized on February 27th. The hospital has remained since then free of diphtheria, so that no third general immunization has been thought necessary.

At the Nursery and Child's Hospital in New York in the three weeks preceding April 18, 1895, there were 15 cases of diphtheria. Upon that day 136 children, varying in age from three weeks to four years, were immunized by receiving from 50 to 200 units each. The children showed no bad effects from the injections. A temporary rise in temperature occurred in one-fourth of them, which lasted for six to twelve hours. From the day of the injections to the present time no diphtheria has developed in the hospital, with two very interesting exceptions—a physician and a nurse who had not been immunized. Since then the hospital has been free from diphtheria.

At the House of Reception of the New York Catholic Protectory 2 cases of diphtheria developed on July 7th, and 3 cases on July 8th and 9th, 1895. On July 9th and 10th the remaining 67 children were injected with 150 to 600 units each. (The children's ages varied between two and a half and fifteen years.) No diphtheria developed after the injections in any of these children. In August a new set of children were received, and on August 5th a case of diphtheria developed among these, and on August 10th a second. On this day the 37 children who comprised the new lot were injected with from 200 to 600 units. No more diphtheria developed.

The dosage was graded as follows:

2 years	1 case	200 units.
3 "	1 "	250 "
6 "	1 "	350 "
7 to 12 years	20 cases	400 to 500 units.
13 to 20 "	14 "	500 to 600 "

The injection having been made in the forenoon, most of the children showed temperatures of from 99° to 99.5° F. the same evening, two or three reaching 100°, and one 100.6° F. During the two days on which observations were made most of the temperatures subsided to normal, a few remaining at 99° F. No cases except those mentioned later showed any constitutional symptoms after the injections. In only 2 cases was there any local irritation. In 1 of these the symptoms promptly subsided without treatment; the other, unfortunately, developed an abscess.

In the last group of cases, 37 in number, specimens of urine were obtained before the injections to compare with those taken after the administration of the serum. The results of the examinations are as follows:

	Before immunization, August 9th.		After immunization, Aug. 11th.		Aug. 13th.
	Sp. gr.	Albumin.	Sp. gr.	Albumin.	Albumin.
Case 1	10.22	Trace.	. .	Negative.	Negative.
" 2	. .	Negative.	10.30	Trace.	"
" 3	. .	"	. .	"	"
" 4	. .	"	. .	"	"
" 5	10.24	30 per cent. in vol.	. .	60 per cent.	"
" 6	.	Negative.	. .	16 per cent.	"

One child showed 30 per cent. in volume of albumin (the urine, after boiling and the addition of nitric acid, was allowed to stand for twenty-four hours, and the deposit was then estimated) in the urine before the treatment, and after the injection there was about 60 per cent. in volume. The urine from the sister of this child showed no albumin before the injection, and gave not the slightest evidence of illness other than the albuminuria at any time, and neither showed any temperature-reaction. In both of these cases, as in all the others, the albumin had entirely disappeared two days later.

Nine days after the injections 1 case developed an urticaria which lasted for twenty-four hours. No other cases showing the skin rashes were observed. At the Reception House of the Juvenile Asylum in New York 4 cases of diphtheria developed during the week ending April 11, 1895. On the 12th the children (to the number of about 70) were injected with from 200 to 400 units.

No cases occurred afterward, except that the boys' attendant and an engineer who handled the clothes from the diphtheria children, and who had not received immunizing injections, developed diphtheria.

To me these results seem conclusive as to the immunizing power of injections of from 100 units of antitoxin upward.

Although in these institutions it was impossible to say that any special child would develop diphtheria, still, as before stated, it was an absolute certainty that in each of these institutions more cases would have developed unless in some way the children could be immunized.

About one-sixth of the children had slight albuminuria, and a much smaller percentage developed it to a greater extent. In none, however, were there any other symptoms pointing to any deleterious action on the kidneys, and in none was the albuminuria more than transitory.

In the blood there was noticed a slight temporary diminution in the number of the red blood-cells; no other changes were observed.

Immunization by New York Health Department Inspectors in Infected Families.—For over a year in families in which diphtheria has occurred, and in which there were other children exposed to infection, the Health Department inspectors, acting on their own judgment as to the necessity, have immunized some of these exposed persons. Most of these cases have been among the tenement-house population. A few cases taken at random from the reports of the inspectors illustrate the method:

Family 1.—Five children in family; 2 cases of diphtheria; the other 3 children, aged nine, eleven, and thirteen years, were immunized; no further cases occurred.

Family 2.—Three children in family; 1 case of diphtheria; 2 other children, aged eight and sixteen years, immunized; 1 child had diphtheria bacilli in the throat at the time. No further cases of diphtheria.

Family 3.—Three children in family; 1 case of diphtheria, 1 of the remaining 2 children immunized; second child, aged sixteen, not immunized. This child developed diphtheria three weeks later, and was successfully treated with the antitoxin.

Cases like the foregoing might be repeated almost indefinitely. 1207 persons had been immunized in this way up to October 1, 1896; of these but 11 developed diphtheria, and all recovered except 1 who had scarlet fever as a complication. The cases were kept under observation until the premises had been disinfected, and this was done until the throats of all were free from bacilli.

By the use of antitoxin it has been possible to stamp out completely diphtheria in four great institutions for the care of children in which it was prevailing in more or less epidemic form. In no instance has there been, so far as can be determined, any serious results from the administration of the remedy for this purpose. The

duration of immunity in many cases is apparently not more than thirty days, but it may be for a much longer time. The doses required to confer immunity are probably between 50 and 300 anti-

Table showing the Number of Cases Immunized in New York City, and the Results.

	No. of cases immunized.	No. of units of antitoxin administered.	No. of cases of diphtheria developing among those immunized between 1 and 30 days.	No. of cases of diphtheria developing within 24 hours.	No. of cases of diphtheria developing after 30 days.	No. of cases of diphtheria that occurred in the institutions previous to immunization.
New York Infant Asylum (1st immunization).	224	100 to 200	1 mild on the 19th day.	0	6	107 cases in 108 days.
New York Infant Asylum (2d immunization).	245	125 to 225	1 mild on the 12th day.	0	4	6 cases in 12 days.
Nursery and Child's Hospital .	136	50 to 200	0	0	0	46 cases in 90 days; 15 cases in 15 days.
New York Juvenile Asylum .	81	150 to 250	0	0	0	12 cases; 3 cases in 2 days.
New York Catholic Protectory	114	150 to 600	0	1	0	5 cases in 3 days.
Bellevue Hospital	11	175 to 225	0	0	0	2 cases in 10 days.
Health Department Inspectors	1207	150 to 500	10 mild, 1 severe.	3	* 3 { 1 : 30 1 : 31 1 : 55	One or more cases in more than 395 families.
Total	2018	. .	13	4	13	

toxin units, according to the age of the individual treated. The following table of all recorded cases gives an idea of the extent to which antitoxin has already been employed in immunization:

Immunization by Antitoxin.

Total cases immunized . . . . . 17,576.
Antitoxin units injected . . . . . 50 to 1000 (usually 150–200).
Attacked within 30 days . . . . . 129 mild, all recovered.
Attacked after 30 days . . . . . 20 mild, all recovered.

No serious after-effects observed which could be ascribed to the antitoxin injected.

The results summarized above, when taken in connection with those detailed earlier, seem to me to encourage us to use antitoxin in immunization much more largely than we have done heretofore. Especially should boards of health urge its use in the tenement districts.

The short duration of its immunizing power is of course a drawback, but, as a rule, one or at least two injections would carry the persons treated safely over the duration of the local infection.

THE USE OF ANTITOXIN IN THE TREATMENT OF DIPHTHERIA.—The results vary greatly according to the time at which it is given. When it is injected before constitutional poisoning has occurred, and

* There may have been more cases of which the department has no knowledge.

while the epithelium of the mucous membrane is mostly intact and the membrane but loosely attached, the effects are very marked. As a rule, within twenty-four hours the local swelling and hyperæmia have largely abated, and the exudate or pseudo-membrane, if scanty, has entirely or largely disappeared, and, if thick and extensive, has assumed a peculiar pulpy condition and seems like a slough ready to be cast off. The fever and restlessness or prostration have usually largely disappeared. In laryngeal cases where stenosis is not as yet marked the symptoms usually abate and intubation or tracheotomy is avoided.

When antitoxin is administered later, when constitutional toxæmia is beginning and local necrosis of the epithelium has taken place, the curative changes wrought by antitoxin are less manifest. In these cases the local lesions cease to advance if they had not already come to a standstill. There is otherwise no striking change. Several days may elapse before the throat is clear. If the disease had already lasted several days, after-paralyses and heart failures are to be feared if the local lesions were very extensive. These cases, in a word, cease to advance, and if not already too far advanced they recover more rapidly but in the same way as other cases not receiving the antitoxin.

The laryngeal cases in which stenosis has advanced too far to yield quickly enough to antitoxin to avoid the tube, usually require the tube for a shorter time than formerly. It is well to make a trial of removing the tube in twenty-four to forty-eight hours. Some require it as long as formerly. The antitoxin appears to be without effect upon broncho-pneumonia. Antitoxin exerts no effect whatever on cases profoundly toxic, nor upon streptococcus or pneumococcus infections. It is usually given in these apparently hopeless cases with the idea that we may have over-estimated their gravity.

The Ill Effects of Diphtheria Antitoxin.—A small percentage of cases have a slight rise of temperature immediately after an injection, and in a very few with the rise of temperature a rash develops. The rash is, however, more apt to develop after the fifth day, and occurs in about 10 per cent. of the cases. The eruption may be limited to the point of injection or may more or less completely cover the entire body. It most often appears as an urticaria or erythema, and frequently fairly closely resembles the rash of scarlet fever, and more rarely that of measles. Following the eruption desquamation may occur. In about one-fifth of the cases the rash is accompanied by a rise in temperature of 2° to 4° F. This lasts from one to four days. In a small percentage of cases there is accompanying the rash great tenderness of some of the joints, with at times swelling and redness. The mild cases recover in a few days; the more severe last for some weeks, all finally recovering. The kid-

neys may be slightly affected, but as they are protected to even a greater extent from further injury by the diphtheria poison, the serum really protects rather than injures them.

The antitoxic serum has no effect on paralysis itself. When given early it prevents the development of lesions in the nerves. Among recoveries there are as large a proportion of persons having paralysis as formerly, the reason being that many severe cases now recover which would formerly have died.

It is well in determining the value of a new remedy to obtain the opinion of a great number of persons who have used it and seen its effects. We have abundant means of obtaining such knowledge.

The report of the Pædiatric Society's antitoxin investigation is very valuable in giving us information upon the results of the use of antitoxin in private practice and the personal opinions of a great many practising physicians. The committee makes the following analysis of its elaborate and exhaustive report:

1. The report includes returns from 615 physicians. Of this number more than 600 have pronounced themselves as strongly in favor of the serum treatment, the great majority being enthusiastic in its advocacy.

2. The cases included have been drawn from localities widely separated from each other, so that any peculiarity of local conditions to which might be ascribed the favorable reports must be excluded.

3. The report includes the record of every case returned, except those in which the evidence of diphtheria was clearly questionable. It will be noted that doubtful cases which recovered have been excluded, while doubtful cases which were fatal have been included.

4. No new cases of sudden death immediately after injection have been returned.

5. The number of cases injected reasonably early in which the serum appeared not to influence the progress of the disease was but 19, these being made up of 9 cases of somewhat doubtful diagnosis, 4 cases of diphtheria complicating measles, and 3 malignant cases in which the progress was so rapid that the cases had passed beyond any reasonable prospect of recovery before the serum was used. In 2 of these the serum was of uncertain strength and of doubtful value.

6. The number of cases in which the patients appeared to have been made worse by serum were 3, and among these there is only 1 new case in which the result may fairly be attributed to the injection.

7. The general mortality in the 5794 cases reported was 12.3 per cent.; excluding the cases moribund at the time of injection or dying within twenty-four hours, it was 8.8 per cent.

8. The most striking improvement was seen in the cases injected

during the first three days. Of 4120 such cases, the mortality was 7.3 per cent.; excluding cases moribund at the time of injection or dying within twenty-four hours, it was 4.8 per cent.

9. The mortality of 1448 cases injected on or after the fourth day was 27 per cent.

10. The most convincing argument, and to the minds of the committee an absolutely unanswerable one, in favor of serum-therapy is found in the results obtained in the 1256 laryngeal cases (membranous croup). In one-half of these recovery took place without operation, in a large proportion of which the symptoms of stenosis were severe. Of the 533 cases in which intubation was performed, the mortality was 25.9 per cent., or less than half as great as has ever been reported by any other method of treatment.

11. The proportion of cases of broncho-pneumonia—5.9 per cent. —is very small and in striking contrast to results published from hospital sources.

12. As against the two or three instances in which the serum is believed to have acted unfavorably upon the heart might be cited a large number in which there was a distinct improvement in the heart's action after the serum was injected.

13. There is very little, if any, evidence to show that nephritis was caused in any case by the injection of serum. The number of cases of genuine nephritis is remarkably small, the deaths from that source numbering but 15.

14. The effect of the serum on the nervous system is less marked than upon any other part of the body, paralytic sequelæ being recorded in 9.7 per cent. of the cases, the reports going to show that the protection afforded by the serum is not great unless injections are made very early.

The committee states that, while it has endeavored to present the favorable results with judicial fairness, it has also tried to give equal or even greater prominence to cases unfavorable to antitoxin. It acknowledges its indebtedness to members of the profession who have co-operated so actively in this investigation, and to Dr. A. R. Guerard for the preparation of the statistical tables. The report is signed by L. Emmett Holt, M. D.; W. P. Northrup, M. D.; Joseph O'Dwyer, M. D.; Samuel S. Adams, M. D.

The Action of the Society upon the Report.—The society voted to accept the report of the committee, and after a full discussion it was decided to embody its conclusions in the following resolutions:

I. For a child over two years old the dosage of antitoxin should be, in all laryngeal cases with stenosis and in all other severe cases, 1500 to 2000 units for the first injection, to be repeated in from eighteen to twenty-four hours if there is no improvement; a third dose

after a similar interval if necessary. For severe cases in children under two years and for mild cases over that age the initial dose should be 1000 units, to be repeated as above, if necessary; a second dose is not usually required. The dosage should always be estimated in antitoxin units, and not of the amount of serum.

II. The most concentrated strength of an absolutely reliable preparation should be used.

III. Antitoxin should be administered as early as possible on a clinical diagnosis, not waiting for a bacteriological culture. However late the first observation is made, an injection should be given unless the progress of the case is favorable and satisfactory.

A most convincing demonstration of the value of antitoxin is furnished by the experience of Baginsky during an involuntary pause in the serum treatment caused by failure in the supply of serum. Between March 15, 1894, and March 15, 1895, there were treated in Baginsky's service by antitoxin 525 children, with a fatality of 15.6 per cent. During the period of forced interruption of the serum treatment, this period being chiefly the months of August and September, 126 children were treated without antitoxin, with a fatality of 48.4 per cent. There was absolutely no selection of cases in either group. In his comments upon this experience Baginsky says:

"It is all the more remarkable as the ratio of mortality of those treated with the serum both before and after the period of interruption varied within very small percentage figures.

"If one will permit figures to speak at all, there has scarcely been made on human beings a more demonstrative test of the curative power of a therapeutic agent. It was an experiment forced upon us, but it proved to us how terrible was the form of disease which we were treating, and how numerous would have been the victims without the use of the healing serum."

Statistics.—The following statistics, gathered by Dr. Guerard, have been kindly furnished for my use. They give valuable testimony as to the value of diphtheria antitoxin.

1. Cases and deaths reported in Berlin and New York and deaths in Paris:

	Berlin.		Paris.	New York.	
Year.	Deaths.	Cases.	Deaths.	Deaths.	Cases.
1889	1284	4220	1890	2291	6489
1890	1586	4586	1859	1783	4350
1891	1078	3504	1531	1970	4874
1892	1405	3683	1557	2106	4654
1893	1643	4315	1266	2558	6468
1894	1430[1]	5220	1009[1]	2870	9155
1895	996	6106	441	1956[1]	9925
1896	588[2]		600[2]	1856[2]	

[1] Use of antitoxin begun.

[2] Last quarter of year, partly estimated.

2. Absolute death-rate per 100,000 population:

Year.	Berlin.	Paris.	New York.
1886	125.7	73.2	187.5
1887	100.7	76.9	206.6
1888	76.1	83.7	167.7
1889	85.6	79.9	146.2
1890	102.0	77.5	110.6
1891	67.5	63.0	118.7
1892	92.9	63.6	123.3
1893	100.8	51.4	145.5
1894	86.7	40.7	158.5
1895	59.7	17.7	105.2
1896	30.9	17.5	91.3

The foregoing tables show that, coincident with the use of antitoxin the actual number of deaths from diphtheria in the cities of Berlin, Paris, and New York decreased.

The reduction in the mortality would be much greater if antitoxin were given to all cases. Even in such cities as New York, where antitoxin is furnished free to poor persons, many still refuse its use. Thus the investigation of 336 consecutive fatal cases occurring during the past summer and fall showed that in 212, or 63 per cent., of them antitoxin was not employed. Even many of those cases in which antitoxin was employed received it too late to hope for any effect; thus, of the 124, 41 were moribund or hopelessly ill at the time of injection, and 33 more were injected after the fifth day. Without regard to our belief in the curative value of antitoxin, we would all agree that where two-thirds of the fatal cases receive no antitoxin it is unfair to assert that the still large, though greatly lessened, mortality present in the cities gives the full measure of the value of antitoxin.

3. Mortality in diphtheria treated with antitoxin, and previous mortality without antitoxin:

	Cases.	Deaths.	Mortality, per cent.	Previous mortality, per cent.
Hospital cases	15,560	3009	19.0	
Private cases	9,208	995	10.1	
Total	24,768	4004	16.0	30 to 40

(Cases moribund at the time or dying within twenty-four hours after are included in these statistics.)

4. Mortality of diphtheria treated with and without antitoxin at the same time or during the same period:

	Cases.	Deaths.	Mortality, per cent.
Hospital, with antitoxin	7986	1754	21.0
" without antitoxin	9039	3309	36.4
Private, with antitoxin	3161	412	13.0
" without antitoxin	4255	1717	40.0
Total, with antitoxin	11,147	2161	19.1
" without antitoxin	13,294	5026	37.8

(The antitoxin cases were often severe cases taken as tests.)

5. Mortality of operative and non-operative cases of diphtheria treated with antitoxin, and previous mortality of operative cases without antitoxin:

	Cases.	Deaths.	Mortality, per cent.	Previous mortality, per cent.
Non-operative cases	12,066	1491	13.5	
Operative cases	3,082	1135	36.7	65
Total	15,148	2626	16.6	
Tracheotomy	1355	569	42.0	70
Intubation	1173	361	30.8	56.5
Intubation and second tracheotomy	52	37	71.0	
Intubation or tracheotomy	502	168	33.2	

6. Mortality of diphtheria with antitoxin, arranged according to age:

	Cases.	Deaths.	Mortality, per cent.	
0–2 years	1494	469	31.4	
2–5 years	3678	762	20.7	
5–10 years	3184	473	14.8	
Over 10 years	1444	99	6.9	
Total	9800	1803	18.4	(chiefly hospital).

7. Mortality of diphtheria with antitoxin, arranged according to day of disease on which treatment was commenced:

	Cases.	Deaths.	Mortality, per cent.
First and second day	4,232	267	6.3
Third and fourth day	3,870	656	17.2
After fourth day	1,984	605	34.6
Day unknown	339	44	13.0
Total	10,425	1672	16.0

(Moribund and dying within twenty-four hours included.)

The results given in the above tables seem to me to absolutely prove that under the diphtheria-antitoxin treatment less than half as many cases die as formerly.

Streptococcus Antitoxin.—The blood of horses which have been subjected to repeated and increasing doses of virulent cultures of streptococci contains certain curative substances which seem to possess both feeble antitoxic and bactericidal properties against the poisons produced by the streptococci and the germs themselves.

As yet developed, these curative substances are far weaker than those in diphtheria antitoxin, and are as yet of more value as a preventive than as a cure.

As already stated, many cases of diphtheria are due to mixed infection, and in many the fatal effect is due largely to a secondary septicæmia, bronchitis, or broncho-pneumonia. These diseases are due

usually to the action of streptococci, less frequently to that of the pneumococci. When due to the streptococcus the serum is probably of some value. The French are enthusiastic in its praise, the Germans doubtful. My own experience in a dozen cases seems to indicate that it has a very moderate preventive and perhaps some curative power. Marmorek's preparation is used in 10 to 15 c.cm. doses, to be repeated every twelve to twenty-four hours so long as the temperature and lesions persist. In time the serum may be of more value.

Diphtheria Bacilli in Healthy Throats.

Investigation has shown that quite frequently the throat-secretions of those who come in contact with diphtheria become infected with diphtheria bacilli. These bacilli may remain inactive in the throat for a time, and then cause later an attack of diphtheria, or they may be transmitted to others, and thus produce disease. The following investigation reveals how frequently bacilli are found in healthy throats: The throats of the healthy children of 14 families, in which one or more of the other members had diphtheria, were examined by cultures. There were, in all, 48 healthy children. In 50 per cent. of these diphtheria bacilli were found; 40 per cent. developed later, to a greater or less extent, the lesions of diphtheria. In considering the high percentage of cases in which the virulent Löffler bacillus was found, it must be remembered that in these families the conditions were the best possible for the transmission of the contagion.

In numerous instances cultures have been made from the throats of healthy children in families where the diphtheria case was well isolated; in such cases the bacilli have been found in less than 10 per cent. of the children. Even here contact with the sick was allowed up to the time the disease was diagnosticated.

Of many examples in which the bacilli in healthy throats have been found to produce diphtheria in the persons infected or in others the following are given as illustrations:

In a family of 8 children 1 child sickened with diphtheria, and a second child, a baby, was sent to a neighbor. The next day cultures showed this baby, as well as 2 of the other children, all of whom were apparently healthy, were infected with diphtheria bacilli. The 3 apparently healthy, but infected, children, as well as the sick one, were at once quarantined, but already one of the family to which the baby had been sent had contracted diphtheria from it.

A very striking instance of this was the following: In a family of 4 children 1 was sick with diphtheria. The department inspector found 3 other children in the same bed with the sick one, who was constantly spitting upon and soiling the bed-clothes. He made cultures from these 3 children, whose throats appeared healthy, as well

as from the sick one; all contained abundant characteristic Löffler bacilli (these were later shown to be virulent by the inoculation of guinea-pigs). When the inspector visited the same family three days later he found that 2 of the previously healthy children had meanwhile sickened and died, and that the third was severely ill. This child finally recovered.

From the observation detailed above we cannot escape the conclusion that all members of an infected household should be regarded as under suspicion, and in those cases where isolation is not enforced the healthy as well as the sick should be prevented from mingling with others until cultures from the throat have shown the absence of bacilli or a sufficient lapse of time gives the presumption that they are not carriers of the contagion.

Diphtheria Bacilli in the Throat-secretions of Convalescent Cases.— The length of time elapsing between the inception of the disease and the date of the last culture showing the presence of the Klebs-Löffler bacillus in the throat of each patient was tabulated at the laboratory for 2150 cases. The average interval between the last culture showing the presence of the bacilli and that showing their disappearance is probably about eight days. The bacilli may, therefore, have persisted in many cases for a longer period than that recorded.

Of the 2150 cases tabulated, in 864 the last cultures showing bacilli to be present were made within six days or less from the inception of the disease, and may be considered in the main as made for diagnosis.

The remaining 1286 cases are tabulated as follows:

Time from inception of disease, bacilli present,	7th day and over.	14th day and over.
Number of cases	1286	741
Per cent. of total cases (2150)	59.81	34.46

Time from inception of disease, bacilli present,	21st day and over.	28th day and over.	35th day and over.	42d day and over.
Number of cases	328	155	68	31
Per cent. of total cases	15.25	7.21	3.16	1.44

Time from inception of disease, bacilli present,	49th day and over.	56th day and over.
Number of cases	16	9
Per cent. of total cases	0.79	0.42

In the 9 cases in which cultures showed the presence of the bacilli for 56 days and over from the inception of the disease these cultures were made as follows: One each on the 57th, 58th, 60th, 61st, 62d, 63d, 64th, 88th, 90th, and 91st days, respectively. The above tabulation is chiefly of interest as showing the long persistence of the Klebs-Löffler bacillus in the throat in exceptional cases.

The virulence of the bacilli thus persisting has been tested in a number of cases, with results entirely confirmatory of those reported for the previous year. In every case tested, the bacilli retained their virulence irrespective of the duration of persistence in the throat. The case in which the bacilli were found to be present on the 91st day presents points of special interest. It was that of a child three months old when first coming under observation, in which the clinical symptoms were confined to a simple nasal discharge. There were no constitutional symptoms whatever. The nurse, and later the mother of the child, contracted diphtheria from it, the disease in the mother's case being of a severe type. The bacilli were tested at frequent intervals up to five weeks from the inception of the disease, and were found to be virulent in every instance.

The demonstration of the frequent presence of diphtheria bacilli for weeks after the complete disappearance of the membrane indicates clearly that the patients must be isolated so far as possible, not only during their illness, but also afterward. The throat-secretions are to be considered dangerous until at least three weeks after the beginning of the attack.

Wherever possible the disappearance of the diphtheria bacilli should be established by the bacteriological examination of cultures. At the conclusion of the illness the bedding and, where possible, the carpets should be disinfected by steam, and the furniture, floor, and walls wiped off with a 1 : 500 solution of bichloride of mercury. Finally, it is well to burn three pounds of sulphur to each 1000 cubic feet of air-space in the patient's room.

The disposal of the children in an infected family is a matter of great importance. They frequently have already become infected before the first case is diagnosticated, and if sent away they may carry the disease to the children in the families which they visit. It is wise, therefore, not to send them away, unless they have not been exposed to the one taken sick, and only then to places where there are no children. All those who have been exposed or expect to be exposed should receive a moderate injection of antitoxin as a preventive, 100 to 300 units according to age. It is well also to frequently gargle the throat and cleanse the nostrils with some mild cleansing solution, such as Dobell's or a weak disinfectant, such as 1 : 10,000 aqueous solution of bichloride of mercury. An immunizing dose of antitoxin, together with the frequent cleansing of the throat, will practically ensure an immunity from diphtheria.

Local Treatment.

If one could destroy the diphtheria bacilli at a time when they are localized, extension of the disease to distant parts might be prevented.

Many clinicians of great experience in the treatment of diphtheria have advised various methods to accomplish this desired result, but personally I believe that their success must always be limited, and for the following reasons: The diphtheria bacilli are not limited to the exact spot where the pseudo-membrane has developed. They are present in the throat-secretion, bathing all parts of the pharynx and tonsils before even the local lesions are manifest. Lying thus in the crypts and recesses of the parts, they are not killed by such antiseptic fluids as are attempted to be applied to them. Further, at those places where local lesions are apparent the bacilli are already present beneath the superficial layers of membrane, and cannot be directly influenced by antiseptic fluids.

If the bacteria were upon a dead surface, we could kill them, but to destroy them without injuring the living epithelium is a very different undertaking. Just a year ago a series of experiments were carried out by the resident physicians of the Willard Parker Hospital for Contagious Diseases (Drs. White and Somerset) to test the comparative value of irrigating the nose and throat with simple cleansing solutions and with disinfectants (1 : 4000 bichloride of mercury and 5- to 10-volume solutions of peroxide of hydrogen). After a pretty thorough trial it was very difficult to see more than a trifling advantage in the antiseptic solutions.

If we attempt to kill the bacilli by caustics or actual cautery, we are apt to injure the tissues without killing the bacteria, so doing more harm than good. I believe, therefore, that we should not use any treatment which will irritate or lacerate the mucous membrane. I believe that no swab should be used to make applications to the mucous membrane unless it is done by the physician or by a trained nurse, and only then with the greatest care. Personally I prefer to trust to irrigation. For the nostrils I prefer a simple tepid salt solution (one teaspoonful of salt to a pint of water). This is best applied through the fountain syringe. If the nostrils are so firmly plugged that great pressure is needed, then an ordinary hard-rubber syringe can be used. To its point is attached a short rubber tube, ending in a bulb, to fit the nostrils. The force needed may be very great, but the shock is of less harm than the continued total occlusion of the nostrils with the probable production of sepsis.

When the local lesions of diphtheria are limited to the tonsils, irrigation of the nostrils is unnecessary, but when the posterior nares and pharynx are involved, the nostrils should be irrigated three to six times a day. Even weak solutions of peroxide of hydrogen are often very irritating to the nasal mucous membrane. Great care should be taken if it is thought desirable to use this substance. For the irrigation of the mouth and pharynx either a normal salt solution or a

1 : 4000 bichloride-of-mercury or a 5-volume peroxide-of-hydrogen solution may be employed.

In older children and adults the cleansing and soothing effects of irrigation are often marked. In these cases I prefer to use irrigation with warm salt solution every hour or two, and then every three hours to irrigate with some antiseptic solution, especially a 1 : 4000 bichloride solution. The irrigation of the throat is, as in the case of the nostrils, best carried out by the fountain syringe.

When the nostrils and pharynx are clogged by discharge and membrane, it is necessary to clean them if the child's strength will permit. For local treatment the solution recommended by Löffler has received high praise. Personally, I do not believe its application gives any better results than bichloride-of-mercury or peroxide-of-hydrogen solution. It is a mixture of menthol ʒiij, dissolved in toluol ʒix, liquor ferri chloridi ℥j, and absolute alcohol ℥ij.

No new drugs besides antitoxin have been added during the past three years that I believe to have any advantage over the older remedies. For feeble heart-action and prostration alcohol and strychnine are still the best remedies. A moderately low temperature and plenty of fresh air are of great importance in the successful treatment of diphtheria. The tincture of the chloride of iron, though still largely given, is used in smaller quantities, and by many its use is not advocated at all.

When there is difficulty in swallowing after intubation or from paralysis of the muscles of deglutition the patient is fed by gavage, the soft-rubber tube being passed, as a rule, through the nostrils. The internal administration of bichloride of mercury seems to me to be of doubtful value.

Inhalations of steam and emetics are not seldom used in laryngeal diphtheria. Calomel fumigation is still employed by many, and undoubtedly has some value in relieving stenosis.

Since the introduction of antitoxin intubation is even more rapidly than formerly replacing tracheotomy. O'Dwyer has recently supplied a new variety of tube for those cases in which the tube-opening becomes frequently plugged with exudate or membrane. These tubes are shorter and of much larger lumen than the usual form. They are of uniform size throughout their entire length, and are made of thin metal.

Antitoxin, though it does not exclude the use of any of the drugs formerly employed, yet, by shortening the duration of the disease and lessening its severity, makes unnecessary the employment of many remedies which are of doubtful value. In many cases we do everything advisable when we require rest in bed and attend to the cleansing of the throat and to the diet.

ASTHMA, BRONCHITIS, AND WHOOPING COUGH.

By NORMAN BRIDGE, M. D.

ASTHMA.

Asthma is a symptom-complex of some inducing pathological state; rather of two or more such states depending on each other. Objectively and subjectively, it is a struggle of more or less severity to force air into and out of the chest. Other symptoms sometimes occur in addition, but these are the primary and essential ones of the disease. We know the smaller bronchi are in some way reduced in diameter or have their lumen reduced, and several theories have been invoked to explain this phenomenon.

It is this lessening of the air-carrying space within the tubes that mechanically and directly induces the symptoms. But the change in the tubes is the result of some other preceding pathological state or irritation, either in this or some other and perhaps far removed part, and which is sometimes undiscoverable. This primary cause is certainly not always the same, but there is small reason to doubt that it generally consists in some disorder, disease, or peculiarity of the nervous system. Asthma occurs mostly in paroxysms coming on suddenly, more often in the night, which last perhaps an hour and suddenly subside, or a seizure may develop slowly, and, whether beginning abruptly or gradually, one may last many hours or days with only occasional fluctuations in severity. The suffering and annoyance from the dyspnœa vary from the most trifling discomfort to the most extreme and pitiful struggle for the breath of life, with profuse perspiration, swollen features, and extreme cyanosis, the patient the while sitting or standing with the body bent slightly forward and the clothing about the neck and chest loosened to give fuller action to the muscles.

Other pathological conditions often accompany it, as bronchitis, emphysema, and bronchorrhœa, but fever never attends pure asthma. Emphysema often develops in the chronic form with chronic bronchitis. A pronounced case of emphysema often appears, for obvious

reasons, to be one of asthma, when there may be at the moment no narrowing of the diameter of the bronchi. During an attack the patient is often completely free from any other symptom than the wheezing and laborious breathing, and before and after it he is often perfectly well, so far as can be discovered.

Numerous circumstances are known to cause paroxysms of asthma. The most important and wellnigh essential condition is some peculiarity of the nervous system, sometimes, but probably not often, hereditary, which for want of a better designation we call personal idiosyncrasy. It is an excessive susceptibility to slight influences that tend to produce an attack, and leads to paroxysms when no other cause can be discovered, the ordinary conditions of the patient's environment being enough at times to bring one on. The susceptibility fluctuates: at one time the inhaling of the dust emanating from an occupied room will cause an attack, at another only the breathing of some extremely irritating substance is capable of doing it. After all, the personal idiosyncrasy may depend mostly on some inscrutable vice of system, of the secretory organs perhaps inducing the nervous susceptibility, rather than in any organic state of this system itself. But often a direct causative condition may be found, especially if we search carefully for it. Various irritating substances inspired often produce it, as vegetable or animal dust of certain kinds; dust from old hay or straw, from feather beds and pillows; powder of ipecacuanha and the fumes of tobacco; various gases, as chlorine; the emanations from burning tar, from horses and their stables, henhouses, and animal cages; from certain flowers, as fragrant lilies and the tuberose; and a hundred other things of the most diverse sorts.

A more common etiological factor, probably, is some irritation of extra-bronchial organs capable of inducing the asthma by reflex action. Irritation of the nasal passages by polypi, hypertrophy, or some extraneous influence, and hyperæsthesia of these parts, cause many cases, just how large a proportion it is impossible to say, but probably 15 to 20 per cent. at least.

A more common cause of the disease or its aggravation is a derangement of some part of the digestive system. In many susceptible persons almost any irregularity in diet, over-eating, or the use of food not easily digested by the particular individual is sure to bring on an attack. Irritation or disease of many other organs may in those predisposed induce disease; among these are the sexual organs in both sexes, the heart, lungs, the spinal column, the kidneys, and the bladder.

There is some recondite influence in certain localities capable of inducing or relieving the affection, and the places differ to some extent for different patients. Hence changes of residence often

relieve, or aggravate, if they do not produce the disorder—as going from a moist to a dry atmosphere, from a lower to a higher altitude, or *vice versâ* (and often a few hundred feet will produce a marked change), or from the city to the country or the reverse.

Then, such nervous influences as fear of asthma or of some other calamity, or fright, apprehension, or mental overwork or worry, are probably capable of inducing, in certain persons, true asthmatic seizures. But quite a proportion of such seizures, at least to first appearances the so-called nervous asthma, are really only instances of the difficult breathing of laryngeal spasm.

The **pathology** of asthma has been the subject of much study and considerable disputation for many years. The physiological or anatomical changes, whatever they are, that directly induce the symptoms must be capable of sudden occurrence. Muscular spasm in the walls of the bronchi would seem to be a rational theory of such change. Muscular fibres exist to a considerable extent in the walls of the small bronchi, which are under the control of the pneumogastric, recurrent laryngeal, and the sympathetic nerves, and it seems to be experimentally proven that by sudden spasmodic contraction they can cause asthmatic breathing. Well-known analogues of such phenomena are the spasm of the glottis, of the sphincters of the bladder, anus, and of the œsophagus. Irritation of the vagi in animals causes contraction of the bronchi and dyspnœa. But it is not necessary to assume that muscular bronchial spasm causes all cases of asthma, nor is it at all likely to be the case. Sudden swelling of the bronchial mucosa can easily create such a narrowing of the air-channels as to make respiration difficult. That such thickening does occur there ought not any longer to be a particle of doubt. A patient will sometimes within a minute after inhaling a whiff of some offensive substance find nasal breathing difficult, and in five minutes quite impossible, from sudden swelling of the nasal mucous membrane. Erectile tissue is a name given to parts of this structure to express its capability for sudden and extreme engorgement.

A meal of shellfish out of condition or at times in perfect condition may cause, always and only in a susceptible person, a marked urticarious swelling of the face, neck, and hands within a few minutes.

Then we have the sudden, startling swelling of the tongue from obscure causes, infrequent but positive, and induced, it seems certain, by some cause outside of the oral cavity, probably in some reflex irritation of the nervous system. The condition usually subsides in a few hours regardless of treatment. Localized swellings of the skin and subcutaneous tissue are common enough, and uninduced by renal or cardiac disease or by obstruction to circulation of the part by pressure, and unassociated with any cause of general anasarca. This con-

dition has been aptly called angio-neurotic œdema—a name that well expresses some of the facts known about it; one it fails to express is that muscular fibres in the vessel-walls are perhaps concerned in producing the phenomena.

Frequently an attack of asthma that has lasted a number of hours without cough will subside with a cough and profuse bronchorrhœa. It is more rational to suppose such an event following what may be called an angio-neurotic swelling of the bronchial mucous membrane than a spasm of the muscular fibres of the bronchi, whose contraction is confined to reducing the diameter of these tubes. Decidedly the muscular-spasm theory is less supported by the facts than that of angio-neurotic swelling of the bronchial mucosa. Nor can the presence of the somewhat characteristic crystals and spirals in the bronchial mucus in cases of asthma be said to particularly support the theory of bronchial spasm. If the crystals are the active causative irritant, as has been suggested, they unquestionably first harm the mucous membrane, and might more readily cause first the angio-neurotic swelling. But since the crystals have been found in the secretions or products of several other parts of the body, in bronchial mucus in non-asthmatic cases, and even develop in bronchial mucus outside the body, and since the spirals have been found in other diseases, they can scarcely be considered as exercising any powerful influence in causing asthma. They are of value for diagnosis, and search for them should be made in any doubtful case.

Some observations have been recorded which indicate that just before an attack of asthma eosinophile corpuscles of the blood and lymphocytes are considerably increased, to lessen promptly afterward; while the neutrophile cells decrease before and increase after an attack. If these changes should be found to be constant, or nearly so, it would be a most important step in the pathology of the disease.

Although asthma from the standpoint of **diagnosis** is usually a self-evident disorder, it is not unfrequently confounded with other affections. Occasionally a case of suddenly occurring severe dyspnœa of uræmia is mistaken for asthma. There should be no difficulty in making the distinction even from the symptoms, for, unless there is pulmonary œdema and much rattling, the character of the breathing is hardly like that of asthma: it is dyspnœa without evident obstruction, and of course if there is much rattling uræmia should be suspected. There is nearly always in a case of uræmia, bad enough to produce paroxysms of dyspnœa, some œdema or cachexia, or both. The absence of these should never lead to the exclusion of renal disease in a suspicious case, but the urine should always be examined critically.

The inability to rest in the horizontal posture without more or less

difficulty of breathing, due to organic heart disease, has led to a diagnosis of asthma, but this could occur only on a most cursory consideration of the symptoms and signs of any case. The breathing is non-asthmatic, the dyspnœa is aggravated by exercise, and in cases where from dilatation and elongation of the blood-vessels of the lungs and thickening of the connective tissue about them, even with the addition of some œdema, there is embarrassed breathing, the barest history of the case and a touch of the pulse will nearly always tell the nature of the case, and auscultation, which should never be omitted in any chest disorder, will certainly discover the heart-lesion.

Spasm of the laryngeal muscles is often enough mistaken for asthma, but here too a little care should make a diagnosis easy. The obstruction is chiefly of inspiration, which is often loud and stridulous while expiration is noiseless (that of asthma is more of expiration) ; in severe cases inspiration is attended with great effort, and the wheezing has a loud laryngeal quality quite unlike that of asthma. The ear inclined toward the patient would generally locate the obstruction in the throat rather than in the chest, and auscultation of the chest fails to discover the fine sibilant râles and the low-pitched, prolonged expiration of true asthma. The respiratory sounds are laryngeal, and more like the quality of extreme bronchial, or even tracheal, breathing, never found in pure asthma. All doubt is cleared up by the laryngoscope, but usually the agitation or youth of the patient makes it impossible to use this instrument.

There is a nervous, hysterical dyspnœa rarely met with supposed to be asthmatic. Sometimes the form is that of laryngeal spasm—laryngismus stridulus ; sometimes a dyspnœa with no particular obstruction, and therefore resembling the uræmic form. This nervous form is sometimes brought on by fright or fear, apprehension, anger, or by over-indulgence in stimulants or brain-poisons of some kind—alcohol, tea, coffee, or tobacco—in which case there is usually some præcordial distress or sense of weight, and more apparent mental fear of suffocation than there is in true asthma.

Membranous croup is sometimes mistaken for asthma, but here, again, the history of the case ought to exclude it, for this form of croup comes on slowly and progresses gradually to the severest dyspnœa, whereas asthma supervenes suddenly. The croup causes aphonia always, asthma never.

Paralysis of the abductors of the vocal cords allows them to fall together and produce more or less obstruction of inspiration, resembling the laryngeal spasm in symptoms and physical signs. The laryngoscope in these cases shows the cords close together with the slightest opening between them. The inspiration is difficult, the expiration always noiseless.

Tumors of the larynx, trachea, bronchi, and lungs, and rarely contractions of adventitious fibrous tissue in fibroid phthisis, causing pressure upon some of the larger bronchi, sometimes appear to simulate asthma, at least to some extent, for the physical signs resemble more those of spasm of the glottis, and the peculiar bronchial quality of breathing is unlike that of asthma. Besides, the tumor or other causal lesion can usually be demonstrated, and the obstruction from tumor or pressure has come on gradually, almost never with the suddenness of a fit of asthma. It is true that in these several pathological conditions there are occasional paroxysms of more marked obstruction and difficulty of breathing, but they are either due to the superaddition of slight spasm of the glottis or to fright or other emotional demoralization on the part of the patient; and in either case the bronchial quality of the breathing is exaggerated.

The disablement of one lung by extensive pleuritic effusion or empyema, throwing all or most of the labor of respiration on the opposite one, has more than once led to a false diagnosis of asthma. But the most casual study of any such case ought to prevent the error.

Emphysema and chronic bronchitis, which usually occur in combination, offer the chief difficulty in diagnosis in a critical study of asthma. The physical signs are, many of them, the same in the two conditions: there are prolonged, low-pitched expiration, sibilant râles, and labored breathing. But at the same time there is often increased percussion resonance, more or less of the "barrel" form of chest, with a history of chronic bronchitis, and many exacerbations of acute inflammation. Asthma is not infrequently associated with chronic bronchitis, and so is in a measure responsible for the occurrence of emphysema. Emphysema and bronchitis, and the two combined, are gradual in their development, and never have any such history of sudden occurrence of dyspnœa as characterizes every case of asthma. If severe enough to produce dyspnœa, this symptom is rather constant; there is never such sudden cessation of dyspnœa as belongs to all cases of asthma. Such exacerbations as do occur are the gradually developed attacks of acute bronchitis implanted upon the chronic form.

The **prognosis** of asthma is favorable so far as concerns immediate danger in a paroxysm. The patient sometimes looks and acts as if he were about to die, but he does not die. But if the seizures are frequent and prolonged, and accompanied by chronic bronchitis, eventually bringing on emphysema, the patient may be worn out and his life shortened, or he may become so reduced as to succumb to an acute attack of the bronchitis, or some intercurrent affection.

Treatment.

The treatment of asthma should be systematic and rational, not hap-hazard, and a definite course of sequential procedure should be carried out if possible.

Frequently, the case is first seen in the midst of a paroxysm, which demands relief at once. Palliatives must generally be used, but even here a hasty inquiry into the cause may enable one to remove it by an emetic (sulphate of zinc 20 to 40 grains, or Turpeth mineral 1 to 4 grains, or ipecacuanha 10 grains), expelling a quantity of undigested food from the stomach, to the instant relief of the patient; or irritating intestinal contents may be expelled by an enema of the normal salt solution (6 parts of chloride of sodium to 1000 of water); or some baneful influence in the atmosphere being respired may be discovered and quickly eliminated; or an irritated nasal mucous membrane may be soothed by the application, on a small probang, of a trifle of a 4 per cent. solution of cocaine or by a simple spray of albolene.

The most simple and generally efficient palliative of an attack, proven by the experience, with or without advice, of unnumbered cases, is the inhalation of the fumes of burning stramonium or potassium nitrate, or the two together. A large number of proprietary preparations of these articles, with various non-essential additions and put up in various forms, have been used with more or less benefit. Many of them contain some balsamic or other aromatic substance capable of producing, besides a pleasant odor, some slight anti-spasmodic effect, but it is safe to say that they all contain one or both of the articles named as their cardinal ingredients. A common domestic compound is made by saturating bibulous paper with a strong solution of saltpetre and the fluid extract of stramonium, and drying it. It burns readily and slowly, and may be used as freely as the patient finds to his advantage. He can hold his face over the burning paper or by the use of a paper funnel concentrate the fumes. Some relief is usually found in a few minutes, but sometimes no benefit is experienced.

The iodide of ethyl is a useful remedy, and may be given cautiously by inhalation; it often gives prompt temporary relief. Chloroform is more promptly efficient, but the relief is evanescent; it requires to be given repeatedly, almost continuously, during an attack. There is danger that if the patient handles it himself he may take too much, may even fall asleep with the open bottle near his face, and fatal narcosis ensue. Ether has nearly the same effect as chloroform, but is rather less efficient and agreeable. Both drugs are safe in any moderate amount, and should be inhaled in many small and repeated doses.

The best way is to press firmly against the open mouth of the bottle a folded napkin, while the bottle is quickly tipped over against it. The cloth will bring away not over 5 to 15 drops, and should be held to the face by the patient himself, who the instant narcosis is even approached will let his hand fall, thus acting as an automatic safeguard against danger. This dose may be repeated as often as necessary. Asthmatic patients are quite tolerant of these drugs, and in the way indicated they may be used for many hours without danger. But at the best they are only a palliative to repress the symptoms until the exciting cause or the greater susceptibility has passed off, and are not known to reduce the frequency of the attacks.

Pyridine is alleged to cut short a paroxysm of asthma when taken by inhalation (a few drops being placed in a saucer and held near the face), and also to cause a freer flow of mucus into the bronchi with a sense of relief. But the odor is so pungent and disagreeable that few patients willingly take it. Inhalations of the nitrite of amyl will sometimes cut short a paroxysm of asthma. The drug should be used with the greatest caution.

The hydrate of chloral is in some cases an efficient remedy for the attack, but is not prophylactic. A large single dose (20 to 30 gr.) is better than several smaller ones, and in a few minutes the relief is usually marked, but sometimes no effect is produced, and the after-symptoms are to a few persons disagreeable. The remedy may be tried if the inhalations are not efficient, but even if it works well and produces no bad after-effects, it should not be used often, for in some people one dose of this drug creates a demand for more.

The nauseants are useful in a paroxysm, especially lobelia, which was more used formerly than now, but these drugs are so disagreeable when carried to the extent of producing marked nausea, which is necessary to have the best effect on the asthma, that patients wisely refuse to take them except as a last resort. A much better class of remedies are the coal-tar analgesic preparations, antipyrin and phenacetin especially, which have real merit and very rarely disagreeable immediate or after-effects. They doubtless act in the same manner as they do in migraine or neuralgia. One rather large dose, 10 or 15 grains (adult), may be taken at the beginning of a paroxysm, and usually need not be repeated. Prompt amelioration is likely to ensue, but sometimes no effect whatever is produced.

Taken at the beginning of an attack, a single dose of morphine ($\frac{1}{8}$–$\frac{1}{4}$ gr. hypodermically) will generally promptly abort it, and if paroxysms occur only at long intervals this is a proper remedy, but if the attacks are frequent and it were to be given each time, the danger of forming the morphine-habit would be a serious objection to its use. Some patients find the after-effects of the morphine so

disagreeable that they prefer to have less relief by the inhalation of the nitre and chloroform, which are unobjectionable on this account.

Intense mental emotion of any sort has long been known to cut short a paroxysm of asthma; and latterly psycho-therapeutics, in some form and degree of hypnotism, has been used with some success. This will hardly become a practical remedy; it can never come into general use, for probably neither the average patient will have it nor the average doctor be able to use it.

In the intervals of the paroxysms means should be sought to prevent recurrences; to this end the cause of them must be found and removed, if possible, and in a majority of cases this is possible. The personal susceptibility cannot be removed, but it can often by judicious measures be reduced in degree, so that the conditions of a wholesome environment will be incapable of producing an attack.

If the patient has had repeated attacks he has probably discovered what produces them, as some form of dust or odor, or some article of diet, or some physiological derangement. In such instances the proper treatment is obvious. Where the cause is not obvious a systematic and patient search is to be made for it. Every organ of the body must be studied in turn to ascertain if it is diseased, or if at the time of the attacks or just prior to each it is in a state of temporary irritation from any cause whatever. If any such disease or irritation is found, even if its coincidence with the seizures cannot be established, it should be dealt with as the possible cause. The removal or amelioration of some distant or apparently unimportant condition of this sort often cures the asthma promptly.

The irritation that oftenest will be found to cause asthma is within the nasal passages or in the naso-pharynx or pharynx. Whether polypi or inflammation, thickening of the tissues or ulceration, the disease should be corrected by surgical measures if necessary. Not every case of asthma will be cured by surgical treatment of these parts even when they are in a positive state of disease, nor should the patient be promised that it will; the polypus should, however, be extirpated and the inflammation treated, and the patient be glad of it, and glad if it also cures the asthma. It will almost certainly be found that cases of asthma that are coincident with nasal polypi are curable by removal of the tumors, especially if the latter are in the lower part of the nares.

The removal or correction of deflected septa and hypertrophied turbinates is less likely to cure asthma, but the probability is sufficient to warrant the measures necessary to correct them, especially if the asthmatic seizures are frequent and severe. The danger from the operation upon the nares in careful hands is slight, and the promise of relief considerable.

If no disease can be identified as a cause, a systematic search is to be made for it outside the body, and the atmosphere the patient breathes is the first object of study. Measures should be taken to ensure its relative purity and, as far as possible, freedom from dust and odors. Everything in the patient's room that could possibly contaminate the air should be removed, including carpets, drapery, all superfluous clothes, beds and pillows of feathers, every article of bed-furnishing that can send dust into the air by any movement of the bed. Of all the offensive dust-producing agencies in the homes of the people, the pillows and beds are unquestionably the worst, especially the pillows. There is not one feather pillow in a hundred in use, by even well-to-do people, out of which dust cannot be seen to gush if the pillow is suddenly squeezed or given a sharp blow. The beds are subject to the same indictment, only their dust is inspired less than that of the pillows. This dust is most irritating to many asthmatics, and is a potent cause of the night-attacks.

The pillows and bed had best be of hair freshly washed and clean, and the ticking and slips, the sheets and blankets (never quilts or comforters), must be washed often enough to ensure their freedom from dust and even odor. The floor of the room should be frequently washed and well dried or wiped with a damp cloth to remove dust, and the walls and ceiling may in some instances receive with benefit the last-named treatment, only less often.

Perfect ventilation should be had, which means manifold more fresh air for the room than the sick or well usually have. At least 1000 cubic feet of fresh air per person should be introduced into the room each hour, and there is no harm from a current of air over the patient's body if he is warmly clothed; he will not take cold. The dwelling of the patient should be examined and every evidence of decomposition within or about it, every cause of mustiness, be removed and its recurrence prevented. The asthmatic patient cannot escape from the bad odors and atmospheric contaminations of his neighbors; the winds will bring them from long distances. But the farther removed their source is, the more they are rendered harmless by dilution, while the mustiness from the cellars and hidden places of his own house he breathes in a concentrated form.

Then a study should be made of the dietary, to see if possibly any article of food or drink taken can be responsible for the attacks, and of the digestive organs as to their condition just prior to the seizures. Correction of diet and cure of disorders of digestion will often prevent attacks, especially if there is a tendency to gastric acidity and a disposition to eat too rapidly and too much, or there is alternating diarrhœa and constipation. These conditions often obtain in gouty and rheumatic patients. If any digestive disorder exists, it is

safe to suspect it as a cause until its correction fails to cure the asthma.

If no cause of the asthma can be discovered, and the practitioner is left to infer that probably a personal idiosyncrasy is responsible for it, he has left to him such measures as have been found empirically to be useful, and such as reduce the irritability of the nervous system.

Of the former, iodide of potassium is more valuable than all other remedies combined. In many cases it is a specific; as long as the patient takes even an occasional dose he escapes. After a course of it sometimes an immunity is enjoyed for a long time; on the other hand, sometimes after it has acted well for a time it loses its effect, and frequently it fails from the first. But among the cases where no cause of the attacks can be found it rarely fails to do some good for a time, and no case of this character should be regarded as incurable till this drug has been faithfully tried. It may be given in (adult) doses of 5 to 30 grains three or four times a day, always beginning with the minimum dose and increasing rather rapidly unless benefit results. No harm comes of the largest dose, and it may be taken many months if necessary. I have known patients to take one or two ten-grain doses each day for nearly a score of years with no apparent injury to health in any way. By this means they could escape the asthma; any attempt to do without the medicine was followed in a few days by a paroxysm. If the iodide of potassium disagrees, the iodide of sodium or the syrup of hydriodic acid should be tried before this form of medication is abandoned.

General alkaline treatment, by means of the bicarbonate of sodium or carbonate of potassium in the usual solutions or in alkaline mineral waters, helps some cases. Whether it is by correcting some digestive disorder or by counteracting a gouty or rheumatic diathesis it would be difficult to say, but the clinical fact gives support to the claim that asthma is in some instances a rheumatic symptom.

Something can be done to reinforce the nervous system and lessen its mobility in the direction of such reflex action as causes asthma. The measures to be resorted to are good hygiene, regulation of the general regimen, various tonic and alterative medicines, and such drugs as lessen nervous irritability, but never depressing agents to the nervous system.

It is by reinforcing the system that nux vomica, quinine, arsenical preparations, and other tonics have been found useful. They are useful in a proportion of cases, not uniformly so, and it is unlikely that any of them exercises a specific influence over the disease. Tonics should be used in small or moderate doses; large ones are liable to disturb the stomach and so increase the asthma. This is

especially true of arsenic, which should be given in the form of arsenate of sodium instead of arsenous acid or arsenite of potassium. The adult dose may be from $\frac{1}{30}$ to $\frac{1}{10}$ grain three or four times a day.

A few drugs probably tend to lessen the reflex irritability of the nervous system and reduce the tendency to paroxysms of asthma. In the so-called idiopathic cases, where the attacks are frequent and there is reason to suspect that the chief cause is the hyperæsthesia of the nerve-centres, atropine or some other form of belladonna may be used for a long time, and to the extent of keeping the patient up to the point of constitutional symptoms. The drug produces little or no depressing effect, and often wards off the asthma. One dose a day is enough, the quantity to be as required. But used in this way it is far inferior to iodide of potassium for the same class of cases. Stramonium preparations and hyoscyamus, valerian and the valerianates, quebracho, and grindelia are useful for the same purpose as the atropine. Grindelia especially has acquired quite a reputation, which seems not to be wholly deserved. The bromides are useful, but if given for a long time the doses should be small, and the sodium salt is the most eligible.

If in spite of treatment the asthma persists, some change in occupation, habits, or residence of the patient should be sought, or all together in succession if necessary. Change of occupation may so alter the environment and conditions of life as to eventually remove some undiscovered cause of the disease and lead to recovery; and it is regrettable that it cannot be oftener resorted to. Change of climate frequently stops asthma completely—just how, it is not easy to say. Victims in a low, moist climate should go to a higher region with drier air. For residents east of the Missouri River no region in the world is superior to Colorado and the country south and southwest of it, clear to the Pacific Ocean. Yet, there, some patients fail of benefit, and some helped for a while re-acquire the disorder. Moreover, cases do originate in that region, but the vast majority of patients migrating thither are benefited to some extent. Only a few, however, recover so completely as to be able to return permanently to their former homes without a recurrence, thus showing that there must have been some cause in the climate they left, either some dust or moisture or other contamination of the air, which they escaped in the new home.

Patients unable to remove to a distant State should make, if necessary, repeated experiments of slight changes in climate and residence. Often a little change will produce a marked effect—a move of a few blocks in a city or a few miles in the country, changing the altitude even a hundred feet; any change is justifiable, and the least promising may work a magical benefit.

BRONCHITIS.

Bronchitis naturally includes tracheitis, and thus is an inflammation of the mucous membrane from the larynx to the air-vesicles of the lungs. It is a very common form of disease, comes in every degree of severity that inflammation can have, from a common cold "on the lungs" to a mortal malady, and in duration from a short-lived attack of a few days to the lapse of several decades. It occurs most to the young and aged, but no age is exempt; and most in the colder climates and seasons—not so much in the lowest temperatures, when the moisture is mostly condensed out of the atmosphere, but in the moderately cold ones. It occurs idiopathically or independently of any other affection, and it is a complication or an accompaniment of many other diseases, especially tuberculosis and the zymotic fevers; probably it occurs more often in measles than any other disease: it is practically a constant symptom of this affection, and some cases of tuberculosis are only bronchitis. It occurs to some degree also by extension or otherwise from inflammation in the neighborhood of the bronchi, as from pleuritis and pneumonia. Bronchial catarrh, usually erroneously called bronchitis, often results from those diseases of the heart, liver, and other organs which cause disturbance of the circulation in the lungs.

Bronchitis attacks people who are housed more than those who live much out of doors, and those reduced in vigor are more likely to have it. It is usually a bilateral disease—it always is if due to general or systemic causes; but it may be unilateral from some circumscribed infection (as tuberculosis), some locally acting cause (as a foreign body inspired), or some congenital defect making a part unable to withstand the normal vicissitudes of respiration. It may be mainly confined to the trachea and larger bronchi, or to the smaller bronchi, or to the smallest of all, the so-called "capillary bronchitis." In each variety the inflammation shades off to the normal surfaces without any sharp lines, and it may begin in one of the parts named and extend to another or to all.

The inflammation involves the mucous membrane and the submucous tissue of the air-tubes, and in the severer chronic forms reaches the peribronchial tissues even, often producing marked and permanent changes in them, such as thickening and contraction, sometimes with dilatation of the medium-sized bronchi in places (bronchiectasis). Of course the contraction of peribronchial tissue to produce dilatation of tubes must be irregular, and be attended with weakening of the tube-walls; a circular one must cause narrowing of a tube. The lumen of the smaller tubes is, from inflammatory thickening, often decreased, causing obstruction in breathing, espe-

cially in expiration, which sometimes leads to emphysematous dilatation of the air-vesicles.

There is nearly always some effusion or deposit upon the mucous surface, which is more or less expectorated, the substance varying from a thin sero-mucus through all grades and conditions of mucoid substance to muco-pus, false membrane, and blood. Transparent mucus and fibrin become opalescent by long retention, and as the acute disease progresses toward recovery the phlegm grows thicker and more tenacious, as well as more opaque. The mucous surface may be excoriated in places, when there is frequently, if not generally, some pus produced. These broken surfaces may occur with trifling constitutional symptoms, and be the seat of tuberculous infection and the beginning of phthisis.

The forms and appearances of bronchitis are so variable and manifold, and so shade off into each other, that it is idle to try to make any accurate classification or one that will do more than form a working basis for study and treatment. Subdivision of the cases into acute, subacute, chronic, purulent, bronchorrhœal, and fibroid forms is useful, and not confusing if we understand that these terms are relative and descriptive, and only strictly applicable to a few typical cases.

It is not surprising that bronchitis is frequent when we consider the vicissitudes of atmospheric contamination and changes to which the bronchi are constantly exposed. The dust of every sort, animal, vegetable, and mineral, various irritating gases, and the products of animal life which we all inhale, especially in the wretchedly ventilated rooms, houses, and places of assembly where we congregate, produce most of the cases; the wonder is that they do not produce more. Such influences might be expected to tax severely so delicate a tissue as the bronchial mucous membrane to keep itself in a physiological state and rid its surface of irritants. The delicate cilia of the bronchial cells can only move the most minute particles, and easily become destroyed or disabled: then any foreign substance must be removed, if at all, by coughing, with or without the aid of mucus to entangle it, or by means of the lymphatics; and, as we all know, these agencies sometimes fail.

Lowered vitality of the system makes it easy for irritants and microorganisms to produce inflammation here as well as elsewhere, and they doubtless cause many cases of bronchitis, both localized and general. But localized bronchitis is due to other causes, as some congenital defect in a part or some peculiar arrangement of the bronchial branchings whereby some spot is embarrassed in its circulation and nutrition. An acute bronchitis recovers in the main, but at these spots the vitality is insufficient for this end, and a chronic inflammation continues, or

possibly the contiguity of some enlarged bronchial gland may lower the vitality of a spot by making the lymphatics unable to take away the irritating substances from these parts.

We usually assume that tuberculosis, which produces many cases of localized bronchitis, does not start in the bronchial surfaces without previous ulceration; but it probably often does, and there is much reason to think that sometimes the bacilli are brought to the part through the blood-current and not in the air, and find a culture-medium in the bronchial surfaces and lungs by reason of lower vitality in the particular spot. Tubercular bronchitis nearly always sooner or later involves the lungs.

Bronchitis is sometimes caused by inspiring foreign substances of tangible size—as contents of the stomach in the act of vomiting, or particles of food by a sudden inspiratory act in the midst of laughter while eating.

The most common cause of bronchitis is so-called cold-catching, a process the nature of which we are to a large extent ignorant of. To explain attacks of bronchitis on this theory is often to express our ignorance of its true etiology.

Poisons in the form of retained effete matter, ptomaïnes due to failure of action of excretory organs, must predispose to the disease, and there is in some a personal susceptibility in this direction that may itself be the result of some diathesis, gouty or rheumatic, or other cause that may be undemonstrable save by the effect of treatment. Moreover, retained excreta and ptomaïnes positively predispose to "colds."

The rate of mortality of bronchitis is not known, as the cases cannot be counted—a majority of them are never seen by a physician—but the rate is certainly low. Most of the deaths are in the young and in children, and from the form known as capillary bronchitis, but deaths are often wrongly attributed to it, since it is demonstrable that many are really due to lobular pneumonia, which often accompanies capillary bronchitis. Many times the bronchial inflammation is secondary to the pneumonia, yet the cases are called capillary bronchitis.

Chronic bronchitis by inducing emphysema finally wears out many patients; in a few it leads to tuberculosis, which destroys life; but it may last many years without greatly impairing the general health. The mortality from acute membranous bronchitis is high, perhaps 20 per cent., possibly higher.

Cough and expectoration are the most constant symptoms of bronchitis, and they present all degrees of severity and many variations in character. If there is much effusion upon the mucous membrane, there is always cough. This act, a single cough-phenomenon, consists in, first, a simultaneous firm closure of the glottis and increase of intra-

thoracic air-pressure by contraction of the chest and of the abdominal wall muscles, and then a sudden, complete opening of the glottis with a violent outrush of air, producing an explosive sound. The conservative purpose of cough is solely to expel offensive matter from the air-passages by this sudden outrush of air, but it is evident that its expulsive force is most effective in the smaller tubes, where a relatively large blast of air can be brought to bear against a little clump of foreign material. Masses of considerable size may rest on the walls of the larger tubes and trachea, and no ordinary coughing effort be sufficient to dislodge them, and a thin layer of effusion or other substance may cling to any of the surfaces and defy the cough to move it.

Cough is provoked by irritation of the nerves of the bronchi, and the causes of the irritation are several. One cause is foreign matter in the tubes, masses of mucus, pus, serum, or blood, or a mixture of them, with or without contamination by inspired air. Another cause is probably decomposition of these products, which provoke an irritation independent of their mere presence; another, and in many cases a nearly constant irritant, is the inflammation itself, which often makes a patient cough excessively without expectoration.

Cough is an erratic symptom: sometimes with severe inflammation there is little of it unless there is free secretion, while at others it is incessant with the most trifling degree of inflammation, leading to the suspicion that some diathetic state or a hyperæsthesia of the bronchial nerves or a reflex cause of some kind is responsible for it; and, again, cough results from the contact of the atmosphere upon markedly hyperæsthetic bronchial surfaces with little or no true inflammation—a state analogous to cutaneous prurigo. Cough is the result of a blind impulse of nature. The nerves cannot know whether the irritant they feel is a mass of mucus or pus that can be removed by a coughing effort, or a sore spot on a tracheal surface; the cough will result the same from each; a foreign body may be expectorated and the cough cease, but a cough from an irritated spot goes on and on.

In acute bronchitis there is frequent fever, rarely very high, unless there is some complication of lobular pneumonia or other disease. Very high fever should always suggest the possibility of an intercurrent disease, especially some essential fever or tuberculosis. Infection by ptomaïnes or otherwise may elevate the regulation point of temperature and so produce fever; it may also cause bronchitis, which itself may incorrectly appear to be the cause of the fever. It is regrettable that we do not know more definitely all the infection causes of fever, as well as the reasons why some cases of apparently severe bronchitis are not attended with fever, while others are.

As might be expected, the cases attended by fever have other constitutional symptoms—more depression, discomfort, anorexia, and digestive derangements, with high-colored, scanty urine—than afebrile cases do.

The more chronic forms rarely have fever, probably never unless there is some part of the diseased region where pus or pus-products of decomposition are retained and absorbed. If this occurs, localized tuberculosis may be suspected, but does not always exist, for in bronchiectasis there may be from some small area slow absorption of non-tuberculous morbid products that cause erratic fever of a low grade. Then there may be a rise of temperature each afternoon, half a degree to two degrees, and yet, if the patients can take good care of themselves, they may endure for years this light, almost daily fever, and suffer only a moderate reduction of their vital powers or of the body-weight.

There is rarely any true pain in the bronchi or in the chest in bronchitis. Often there is a sense of rawness along the trachea and perhaps in the larger bronchi, not infrequently located by the patient at the mid-sternum or below it, but rarely constant for more than a few hours, and then in the more acute cases; in the chronic ones there is commonly no pain or discomfort, but a trifling sense of constriction across the chest may be present. Most often of all may be a sense of tickling, itching, or titillation of the trachea or bronchi or in the larynx or pharynx and attributed to the passages below, and causing a disposition to cough that, because it does not bring up any phlegm, is called a dry or hacking cough.

In the croupous or membranous variety of bronchitis, usually an acute, rapidly developing disease, there is more constitutional disturbance, fever and all its accompaniments, perhaps from the general infection of the system by the cause of the false membrane. If the bronchial surface involved is large, there may be embarrassment of respiration and all the symptoms of profound sickness, and the danger of death is great. Even after numerous casts of the bronchi are coughed up the danger is not over, for the fever and prostration may continue some days. There is a rare, sharply localized recurring croupous bronchitis that is almost devoid of danger. The constitutional symptoms are mild or absent, and the seizure lasts perhaps a week, usually to the great solicitude of the patient.

Common acute bronchitis runs a course up to a limit of two weeks, but the febrile period is often not half as long. The expectoration of muco-pus may continue from a week to a month thereafter. In the acute stage, especially in a child and when the capillary tubes are involved, there may be extreme dyspnœa with cyanosis, and high fever with drowsiness. Then the prognosis is grave.

The diagnosis in bronchitis in all forms and degrees is not always so easy as it seems. It is confused with irritative, non-inflammatory cough, with lobar pneumonia (catarrhal pneumonia has always bronchitis as an accompaniment), with the bronchial congestion of organic heart disease, and with the bronchorrhœa of nephritis.

After the characteristic signs appear lobar pneumonia should be easily distinguished by these: high fever, bronchial breathing, high-pitched, prolonged expiration, perhaps crepitant râles, dulness on percussion, and rusty sputa. Examination of the heart should easily distinguish organic disease of this organ and whether it is the cause of increased vascular pressure in the lungs; if it is, then the pulmonary second sound is usually accentuated. In apparently pure tubercular bronchitis there is usually some thickening of the trabecular tissue of the lungs, which is shown at least by a slight increase of fremitus, a reduction of the vesicular murmur perhaps, and slight prolongation of the expiration; these signs, too, are often unilateral, or worse on one side, always suggestive of tuberculosis.

Many cases of slight non-tuberculous bronchitis must be diagnosed solely by the symptoms; there are no physical signs, save perhaps so slight an increase in the normal bronchial quality of the breathing as almost to escape detection. This is particularly the case with inflammation of the lower trachea and the larger tubes; there are no râles, and the bronchial breathing is so slight as to raise the doubt as to whether it may not be normal to the individual. Of course there is no change in the resonance, except trifling dulness at spots where there is lobular pneumonia; these spots are mostly not demonstrable, and usually in the chronic cases a slight degree of emphysema increases the resonance.

The laryngoscope reveals some redness in the acute cases, with swelling of the trachea and the bronchi at the bifurcation.

Every sort of râles and rhonchi is heard in bronchitis (except perhaps the crepitant ones), from the moist subcrepitant râles of capillary bronchitis to the coarse, dry rhonchi of the subacute and chronic forms. They are subject to much fluctuation from day to day, even from hour to hour, but in pure non-tubercular bronchitis they are usually bilateral. Râles that are persistently unilateral suggest either tuberculosis or localized pneumonia.

Treatment.

The proper treatment of bronchitis depends on the stage and character of the inflammation. Many patients are treated domestically with nothing but a variety of expectorants and with some irritating or warm applications to the chest. In many such cases

recovery is prompt enough and without the patients ceasing their daily duties.

For an acute case of any severity, especially if much fever is present, the most useful measure is recumbency in bed for a few days, two at least, and in a well-ventilated room. At the same time the patient should be so warmly clothed over his whole body as to keep him constantly on the verge of perspiration. Bed-clothes are not enough, for the arms are sure to be out of bed much of the time, and the shoulders need more warmth than any common night-gown supplies. A good addition to the bed-clothing is a sack, a jacket, or a nightingale (a piece of wool-flannel a yard wide and two yards long, covering the shoulders and arms and pinned at the neck and wrist), which prevents the chilling of the upper portion of the body. The night-gown should be made of wool. In this way rest in bed more powerfully aids in the restoration than any other treatment, for it reduces the exercise of the body to a minimum and gives the system, often lowered in vigor as the attacks come on, rest for recuperation; and it guards against temperature-changes, as well as other vicissitudes that might prolong the attack by keeping up the bronchial congestion.

By promptly resorting to this treatment, with the addition of an opiate—10 grains of Dover's powder or its equivalent—an attack of acute bronchitis may often be aborted and brought to an end in two days that otherwise might continue for weeks. There is some, but not great, reason to think that quinine given to the point of cinchonism aids in this consummation.

Hot poultices and other fomentations to the chest are popular in certain quarters, and are useful if they can be maintained at a high-enough temperature. But they require to be changed frequently; if allowed to become cold, they do positive harm, and in the act of changing them the body is exposed to the air and may be chilled. At best, they are only an article of clothing, and are not half so workable and convenient as a jacket made of thick cotton or wool; they are subject to more dangers in use than the latter, and are not a particle more useful. Nothing has shown more the value in acute bronchitis of warm clothing for the body than the good effect of these chest-dressings, and general clothing of the body as a whole is quite as valuable.

The patient should be cautiously and well fed with the most digestible food—should have the bowels kept free and take tonics, especially the bitter and stimulating ones. One grain of quinine and a sixtieth grain of strychnine every two to four hours, with some aromatic, and some small doses of alcoholic stimulant if the latter be allowable, constitute perhaps as useful a combination as any.

Anodynes in moderation are called for if there is much discomfort or excessive cough, or cough beyond the necessities of freeing the passages of phlegm. Codeine is one of the best; morphine or opium in some form, with ipecacuanha or tartar emetic for a slight expectorant effect, is perhaps next in value. Paregoric is an eligible quieting compound, and may profitably be given with syrup of ipecac and of squills, in equal parts. These anodynes should be used in the smallest doses capable of producing the desired effect, unless one full dose is given in the hope of aborting an attack. They should never be given to "stop the cough" so long as it brings up phlegm, but may be used to quiet an aggravating, useless cough. Opiates should be used with great caution in infants and children. A good combination for children who object to taking medicine is $\frac{1}{4}$ grain of morphine and 1 grain of tartar emetic in a gobletful of water, a teaspoonful being taken once in one to four hours according to the severity of the cough and distress. A child will rarely object to it, and each dose represents about $\frac{1}{250}$ and $\frac{1}{60}$ grain of the drugs respectively, which are safe.

Some of the expectorant drugs with anodynes are allowable when the cough is "dry;" they tend to cause a freer flow of mucus and serum, making a phlegm which the cough can easily expel. The most useful expectorants are ipecacuanha, squill, senega, sanguinaria, tartar emetic, and apomorphine, which should always be administered at first in minimum doses, to be increased if necessary, but there is no need of ever carrying them to the point of nausea. In my observation ipecac and tartar emetic stand first for acute, sthenic cases; apomorphine is much prized by some practitioners, but is less useful. Free expectoration has the advantage of carrying off particles of inhaled dust that may irritate the respiratory membranes, and may in some other manner, as it often seems to, still further relieve the irritation. But the indiscriminate use of anodyne expectorants in colds and coughs is mischievous, for they often impair the digestion, reduce the appetite, cause constipation, and stop or lessen a cough that is most salutary in removing offensive materials from the bronchi, and in these ways doubtless prolong many cases of bronchitis. The irritation of the bronchi that causes a dry cough may often be assuaged by inhaling steam from a vessel of boiling water. A little turpentine may sometimes be added to the water with benefit. Inhalations of pyridine are useful for this condition.

In the recovery from acute bronchitis warm clothing should be maintained, and a mild tonic treatment continued; overwork should be avoided lest it retard the recovery; good feeding, but not overfeeding, and perfect digestion are important.

In the capillary bronchitis in infants and children the treatment

with stimulating tonics, warm applications to the body, especially the chest, and perfect quiescence in bed should be insisted on. The anodynes may be used if necessary, but always with caution as to doses; nothing approaching narcotism is ever safe for a moment. The danger of giving too much medicine to these young patients, doses too large and too many, is one that every practitioner should guard against. Most such patients are overdosed.

The treatment of the more chronic forms of bronchitis requires special consideration. Here we have an inflammation of a lower order of activity than the acute, and one which for some reason tends to continue. The tendency of every inflammation of mucous membranes must be to recovery; yet here is one that often goes on for months and years. There must be some cause that directly keeps it up; it does not continue from total depravity of the tissues or the physiological processes.

The first rational step in treatment would be to remove the cause if possible. One of the causes is certainly irritating things inhaled, as dust of various kinds, and irritating gases, such as sometimes provoke attacks of asthma. It is possible that some persons have bronchial mucous membranes preternaturally sensitive to irritation. They acquire chronic bronchitis from the irritating properties of the atmosphere that to the average person produce no effect whatever. For perfect safety such patients require a selected and protected atmosphere to breathe. Better ventilation of rooms occupied by the patient at his work and in his home would do much to remove these injurious influences. This is the first and greatest step in the direction named, and perfect ventilation means the admission of an amazing amount of fresh air into the rooms constantly. If the occupation involves exposure to a great deal of irritating dust or gases, it should be abandoned for something less baneful.

A high degree of humidity of the atmosphere when cold—near the freezing-point—tends in some susceptible persons to produce or prolong the disease. Only a change of climate would completely eliminate this cause, but the patient can usually clothe himself in such a manner as to minify the effect of the damp cold. Chilling of the surface of the body is more harmful than the damp air, especially in a person below his normal standard of vigor, and such patients usually are feeble.

People in general are too fearful of feeling warm and of perspiring, and patients with chronic bronchitis need to learn to feel warm and insist on it at all times. They should sleep in woollen night-gowns winter and summer, and wear woollen underclothes during the day, and of as heavy weight as they can bear. If the wool irritates the skin, a thin silk or cotton or loosely woven linen garment may be

worn under it. At night the clothing should be so abundant that thorough room-ventilation may be allowed without harm. There will be no cold-taking if the body is warm, even if a draught of air is felt over the face, but a woollen night-cap may be required to complete the clothing.

Chest-protectors of leather or flannel are of value in some cases, especially where the clothing worn over the anterior chest-surface is thinner than that which covers the rest of the body; but except in such cases they are not as good as a uniform distribution of clothing. To keep the chest warm and allow the limbs to be cold cannot be expected to help a chronic bronchitis.

The evidence is considerable that the disease is sometimes prolonged, if not caused, by retained excreta, by some failure of depuration, or by some diathesis. Of the latter the rheumatic and gouty are just now coming to be held responsible for many symptoms not formerly suspected to have any connection with them. Neuralgic pains in various parts of the body, migraine, sore muscles, and various inflammations of mucous membranes are now attributed to retained uric acid or the rheumatic diathesis, and, it may be said, with good show of reason. This possibility should always be considered in chronic bronchitis, and if there is even a moderate probability of the existence of the gouty or rheumatic diathesis, the antidotal treatment should be tried; no harm can come to the patient from a few weeks' anti-lithæmic or anti-rheumatic treatment and much good may be done.

Organic heart disease, such as mitral regurgitation or obstructive lesions, causing distention of the bronchial vessels, always produces congestion of the mucous membrane and frequently cough, and if not actual inflammation it may at least prolong the latter. Measures to ease the load and to increase the strength of the heart are valuable; hence reduction of exercise, a careful life, free elimination, and the use of digitalis and strophanthus are in order.

Many cases of chronic bronchitis are greatly helped by medium doses, long continued, of iodides of sodium and potassium—just why it is impossible to say. This form of medication should always be tried in those cases not due to removable causes. General tonics should also be used for a long time if the system is below its standard, cod-liver oil and the Peruvian bark bitters being the best, but the latter should not be given in large doses. The arsenate of sodium in small doses ($\frac{1}{60}$ to $\frac{1}{30}$ grain), long continued, will help a proportion of such cases. Many practitioners have faith in a patient use of the various balsams taken internally in doses so moderate in size as not to disturb the stomach. Those especially to be mentioned are balsam of Peru, Canada balsam, and balsam of copaiba. The emulsion is a good form in which to take them. A protracted use of small doses

of some of the expectorants (without opium or its preparations) helps chronic cases sometimes, but if they interfere with the digestion and nutrition they should be abandoned at once. Inhalations of vapors of balsams, alteratives, and antiseptics, commended in this paper for bronchiectasis, are of some value in this class of cases, but to do much good they must be long continued, and patients often get tired of them or complain that they irritate and annoy rather than help. Where there is little expectoration and much cough the inhalation of pyridine may be used with benefit; it may soothe the irritation and produce a muco-serous exudation that is to a degree protective to the mucous surfaces and helps to carry off old and irritating accumulations.

For bronchorrhœa turpentine and terpine hydrate have been highly commended. They may be taken in small doses for a long time if they do not disturb the stomach. The balsams already referred to have some reputation for the same purpose, but of course no such specific medication is at all comparable to those measures that increase the vigor of the body and enhance its resisting power.

In bronchiectasis the aim should be to keep the bronchial cavities empty; especially is this important if the expectoration is fœtid, for it is reasonable to suppose that decomposition of the contents of a cavity will increase the irritation of its walls and prolong and aggravate the peribronchitis, if it does not keep the temperature elevated. Inhalations of various gaseous antiseptics have been used, but with small benefit. Iodide of ethyl 1 part, eucalyptol 1 part, alcohol or compound spirits of ether 6 or 8 parts, make a good inhalant, which may be respired from a sponge in a large-mouthed bottle, a few inspirations at a time, several times a day. The monochlor phenol, inhaled through a glass tube containing a small pledget of cotton saturated with the drug, does some good; its vapor is heavier than air, and hence would tend to remain in the lungs and prevent or retard decomposition. This drug is disagreeably malodorous. Sprays of diluted peroxide of hydrogen have been used, but it is doubtful that they reach the bronchiectatic cavities; they would readily prevent fœtor if they did.

If the cavities can be evacuated frequently, the fœtor is nearly sure to stop; the contents are retained because of gravity; hence inverting the body for a few minutes at a time, or changing its position so as to favor the outflow into large bronchi and the trachea, will often enable the patient to evacuate the accumulation, and he can perform the manœuvre at will.

The most useful treatment of very chronic bronchitis is change of climate, and life in the open air. Dry atmospheres are useful, as are high altitudes also in many cases. The greatest advantage comes from living in such places as favor out-door life at all seasons of the

year. The best climates of America for this purpose are those of Colorado, Southern California, New Mexico, and Arizona. These present every gradation of humidity from moderate (Southern California) to extreme dryness (Arizona), and all altitudes from sea-level or below it in the Colorado Desert in Southern California to seven thousand feet or more elevation in Arizona, Colorado, and New Mexico.

For many chronic patients who live in cities and breathe, as all such must, a contaminated and impure air both in and out of doors, it is quite impossible to effect a cure at home. A few months' residence in the climates and conditions named will generally produce a marked improvement if not a complete cure; several years of residence is much more useful.

The good effect of the climate is increased by frequent cool or cold baths, with brisk rubbing or massage to produce a glow of reaction. Many physicians claim that cold bathing will "toughen" people, especially children, and prevent recurrences of bronchitis. Living in the best climate is no reason for sleeping in a poorly ventilated room; the bronchitis patient must always and everywhere breathe the best air.

WHOOPING COUGH.

WHOOPING COUGH is a zymotic, doubtless microbic, disease affecting chiefly infants and children. It is self-limited, and is probably transmitted through the breath or sputum, or both, and renders its victim immune for a certain period from further attacks of the disease. It is characterized sometimes at first and temporarily by slight elevation of temperature, which soon subsides, and for a few days by all the symptoms of a moderately severe catarrh of the respiratory mucous membrane, sometimes of the eyes also, and especially by a common cough, which later becomes distinctly paroxysmal in character and lasts in this form usually from two to eight weeks. The fits of coughing occur at varying intervals of a few minutes to as many hours, and last from a few seconds to a minute or more, and are intense in the rapidity and force of the successive coughing efforts, and in the excess of the expiratory over the inspiratory efforts: the lungs are emptied of all that is possible of their residual air by several expiratory efforts in quick succession, after which, and when the fit appears to be mostly spent, there is a deep, long inspiratory effort, often against slight spasmodic closure of the glottis, and so producing a whooping sound, whence the name of disease is derived.

The patient often feels premonitory sensations of an approaching attack, and may clutch at something for support; during the fit his conjunctivæ are suffused, his face may be swollen and purple, eyes distinctly protruding, and the skin is moist with perspiration, while his whole aspect gives evidence of a profound muscular effort; and at the end of the paroxysm, if not in the midst of it, he may vomit freely.

The disease through all the later days of its course usually appears to be strictly a spasmodic nervous affection; there is no fever, and if vomiting is not so constant as to deprive the system of sufficient nourishment, not much weight is lost nor debility induced: between the paroxysms there is no cough at all nor special evidence of a cold or of bronchitis; and the patient goes about much like a well person, except for the fits of coughing, which are frequently provoked or precipitated by exercise, excitement, draughts of air, or by eating, and are nearly always worse at night, when these exciting causes cannot be operative.

There are no known lesions of the disease save the initial catarrh of the respiratory mucous membrane, and later slight irritation of the larynx, epiglottis, and trachea. The larynx is extremely sensitive to irritants of any kind. The micro-organism producing the disease has not yet been demonstrated with certainty, although two different ones at least have been thought to be the cause.

Deaths often occur from the disease in infants and very young children, rarely in older persons, and then almost wholly from complications. The most common cause is lowered vitality, due to the varying effects of severe and frequent paroxysms and the loss of meals by vomiting; and intercurrent diseases occur easily under such circumstances. One of the more common is bronchitis with catarrhal pneumonia, which is undoubtedly produced sometimes by the inspiration of particles of stomach-contents at the time of vomiting. But the automatic closing of the glottis which occurs at the end of many paroxysms is, although momentary, enough to prevent to a large degree the inspiration of food and mucus, and so is a conservative phenomenon. Another complication that destroys a proportion of infant patients is convulsions—an accident not to be surprised at when we consider the severe strain to which the circulatory apparatus of the cerebrum is subjected in the paroxysms of cough.

As a further result of the strain which the blood-vessels have to bear, occasional hæmorrhages occur, sometimes severe, from various mucous and serous membranes, as the nose, mouth, throat and stomach, bowels, and even the pia mater. Temporary blindness may occur.

The **prognosis** is bad in proportion as the fits of coughing are frequent and severe; frequent paroxysms with emesis and resulting poor nutrition, especially in delicate subjects (either from debility or

youth), speak for the gravity of the prognosis; infrequent paroxysms that do not or only rarely evacuate the stomach, in vigorous patients able to maintain their nutrition, speak for trifling danger.

The diagnosis is rarely difficult after the cough has become paroxysmal and the early catarrhal symptoms have subsided. Before this period cases resemble an ordinary cold or the influenza, and the diagnosis can often not be cleared up till the second stage of pertussis develops.

The cough of a paroxysmal character is the only symptom that is invariably present and noticeable. The whooping sound is occasionally absent, and may be present in other diseases, and the catarrhal symptoms at first may be so slight as to be denied by the patient. The spells of cough with tranquil intervals are never absent. Few other disturbances produce such paroxysms. There is such a thing as a nervous cough produced by other recondite irritants than the poison of whooping cough; it occurs more in adults than in children. Sometimes it appears to be due to ptomaïnes absorbed from the intestines, or to uræmia, or a rheumatic diathesis; sometimes to a moderate laryngeal irritation in a very nervous person; sometimes to foreign bodies inspired into the bronchi, as particles of food, which may produce occasional fits of coughing for many weeks. Generally, in all these conditions the cough has not quite the sharp, quick, incisive, spiteful character of that of pertussis, with the long, deep inspiration at the end of the fit and the calm that follows.

Whooping-cough patients should be isolated from other children as soon as a diagnosis is made; children who have never had the disease should be kept away from them. The act of some parents, on the assumption that their children must some time have the disease, and might as well have it one time as another, of knowingly permitting their exposure to it, is little less than a crime. Susceptibility decreases with the age, and if a child can be spared till his tenth year he is likely to escape through life, or if he does acquire the disease its dangers will be greatly reduced. All clothing used by or about the child, all utensils and fomites, should be disinfected by thorough boiling or by dry heat.

It is almost certain that a patient is capable of infecting others for at least a week or ten days after the paroxysms cease, and it is unfortunately probable that the infection is given before the paroxysmal character of the cough makes the diagnosis certain.

Treatment.

There is no specific treatment for whooping cough, since the etiology of the disease is unknown. Nevertheless, there are many useful things to be done which may increase the prospects of recovery. Of course the prime object of treatment is to lessen the

frequency and severity of the fits of coughing and to assuage the irritability of the upper air-passages.

As the disease is limited in duration, it is manifest that if the strength of the patient can be maintained and accidents can be avoided he will recover. To this end his nutrition must be kept up; if he vomits his food in the coughing spells, he should take a little easily digested or predigested food every hour or after each act of emesis. Some of the infant or invalid foods do very well, or, better, the expressed juice of slightly cooked fresh beef; a lemon-squeezer or a press of iron may be used to express the juice. Curdled eggs or raw eggs beaten up with milk or water constitute one of the best of all foods for such patients. If the patient will take them, four to eight eggs a day are not too much for a child of four years, in addition to two to six ounces of meat-juice, with perhaps other foods. If only a small part of this is absorbed, it will quite effectually prevent any loss of weight or any great loss of strength, but it will never do in a severe case to rely on the usual three meals a day; there would better be a dozen meal-times a day than three.

Tonics and stimulants are useful to the same end, and, if possible, should always be employed where depreciation of the vital powers is apparent. Strychnine and quinine are the best of all tonic medicines, but it is often difficult or impossible to give them to young children, owing to their bitterness. The taste can be covered to some degree by the syrup of coffee, liquorice, or chocolate, and occasionally a child can swallow a pill or capsule. It is not necessary to give large doses; the equivalent of an adult dose of $\frac{1}{40}$ grain of the former and 1 grain of the latter, according to the age of the child, and three or four doses a day, is enough. The tincture of the chloride of iron is useful, and may be given to almost any child in lemonade or milk. If vomiting occurs soon after a dose is taken, another should be given immediately. Alcoholic tonics are eligible or demanded in all cases of debility: they should not ordinarily be given in the milder cases. Children usually stoutly object to the odor of whiskey and brandy. When given these liquids should be diluted with six or eight times as much slightly sweetened water; this often removes the objection to their taste and smell. Deodorized alcohol (Cologne spirits) has very little odor, and may be given surreptitiously in water, milk, or lemonade to almost any child. It is an advantage, too, that only half the dose is necessary as compared with whiskey and brandy. It is difficult to say just what the daily dosage should be in a case; only enough should be given for a tonic effect; no stimulation above the physiological standard should be allowed, nor should any drug or stimulant be taken if it disturbs the stomach so as to impair its power of digestion or cause vomiting to be more frequent.

Something more can be done by various treatments to lessen the frequency and severity of the fits of coughing and to ward off complications, and almost countless drugs and measures have been invoked to this end. But if the strength, vigor, and weight of the patient can be maintained by the measures recommended above or otherwise, more is accomplished to lessen the discomfort from this disease and its mortality than if all other good influences combined are used to the neglect of these considerations.

The first step in this direction is to protect the child, if possible, from all influences that aggravate the disorder and precipitate attacks; hence, excitement must be avoided, and over-exercise, cold winds, and too much or too little clothing. The child should, in short, be guarded by as perfect hygienic conditions as possible, to the end that complications may be prevented and the body-vigor be kept at as high a standard as possible. Too much exercise and excitement are sure to lower the vital powers and increase the frequency and severity of the coughing fits; keeping the patient up to his most perfect standard of vigor lessens the number and force of them. He should be kept in well-ventilated rooms, and be so well clad in warm woollens that a slight draught will not harm him. Fear of draughts nearly always leads to poor ventilation, and an abundance of clothes is a good remedy. The night-clothes should be long and closed at the bottom in the form of pajamas or otherwise, to prevent the child from kicking himself naked.

The tonics already recommended lessen the tendency to the occurrence of paroxysms by reinforcing the nervous system, and quinine has some reputation for markedly reducing the cough, when taken in liberal—that is, cinchonizing—doses. Used in this way, it is one of the most useful of all drugs. It cannot be continued in such doses throughout the sickness if this lasts several weeks, but it may be given to the verge of cinchonism, and kept just short of it as long as the disease lasts, provided it seems to do good and does not disturb the stomach or make the head ache, for it may cause the latter without the tinnitus of cinchonism.

As the chief symptoms of pertussis are nervous in character, it is natural that the profession should have sought to cure or abbreviate the disease by measures addressed to the nervous system. To lessen the nervous irritability seems a prime desideratum, and almost every drug having any reputation for this purpose has been used at one time or another. Some dozens of them have been lauded as efficacious by their respective advocates, to be condemned as useless by others more sceptical who have tried them. It were a waste of space to recount all this testimony, for it is evident that much of it that is favorable has been given on insufficient observation in too few cases, and prob-

ably some of the adverse evidence is no better. One thing is clear—namely, that no anodyne drug should be used, except under the stress of some emergency, if it disturbs the digestion or interferes with the nutritive functions or the powers of life. Hence, opium and all its preparations and derivatives are objectionable, although they do sometimes temporarily reduce the paroxysms, and perhaps vomiting also. They should be used only when a strictly temporary effect is required, and then in minimum doses, and the safest preparation of the list is codeine or some of its salts.

The coal-tar products, antipyrin, acetanilid, phenacetin, and others, have been employed with temporary benefit, but their use through the weeks of the course of the disease, in doses sufficient to temper the symptoms, is certainly likely to lower the vitality enough to counteract their good effects. Of them all, antipyrin seems to be the best, and may be given in the dose of 5–10 grains (for an adult), repeated several times a day in cases demanding it.

Little treatment is required during the catarrhal period. If the cough and catarrh are excessive, a weak mixture of morphine and tartar emetic may be used very cautiously, as recommended in the section on Bronchitis. Any child will take it readily, and disagreeable mixtures are not called for. The trifling fever never requires treatment, and the use of so-called "fever mixtures" containing aconite are somewhat worse than useless. The bowels should not be allowed to be constipated, and laxatives may be needed, the best for children being calomel or castor oil.

If the patient is restless and wakeful, a little bromide of sodium or antipyrin, sulfonal, or trional may be given.

For the paroxysms, musk, valerian, asafœtida, and this class of stimulating anodynes are rational, but cannot do a great deal of good, and are offensive to children.

The most rational class of drugs consists of the compounds of bromine, the bromides, hydrobromic acid, and bromoform, and they must be given continuously for many days. The effect of these is to lessen the irritability of the nerve-centres, and so if possible to decrease the paroxysms. While good effects might be expected from this entire class, only the bromoform has acquired any marked reputation in this disease; and as to this there are very conflicting claims and testimony. Some insist that it is a sort of specific, and always cuts short the disease or lessens the severity and frequency of the attacks; others as stoutly declare that it produces no perceptible effect whatever. Probably the truth lies between them: the drug is not a specific, but it does mitigate the severity of the disease, and by virtue of its bromine, and any other form of bromine used as faithfully might be expected to do nearly as well.

Bromoform is an oily liquid, and may be given from 1 to 8 drops at a dose, depending upon the age of the child, in a drachm or two of water (with which it does not mix). Three to six doses may be given a day, according to the severity of the disease. Children take the drug well enough, but it is decomposed by the daylight and therefore must be kept in the dark.

If in spite of the treatment the sleep is greatly disturbed by the cough, hydrate of chloral is eligible; it both quiets the cough and induces sleep; but the smallest dose capable of accomplishing the purpose should be used. If convulsions occur or are threatened, this is the most useful drug of all.

Belladonna was once in high favor for quieting the irritability of the nervous system, and it deserves to be more often employed. It has the advantage of being safe in doses sufficient to produce its constitutional effects, and should be continued throughout the sickness. Atropine is the most reliable preparation, and should be given in the (adult) dose of $\frac{1}{200}$ grain, repeated often enough and in increasing doses, if necessary, to produce very slight dryness of the throat and possibly a little flushing of the face.

In cases of great prostration and evident overstrain of the heart with dilatation digitalis is useful.

Chloroform may be wisely given by inhalation in extreme cases where it seems imperatively necessary to cut short the individual paroxysms. But only an experienced and careful nurse should be entrusted with its administration. A few drops on a cloth held to the nose the instant a paroxysm is imminent will stop or lessen it, provided one or two full inspirations can be taken before the attack is fully under way.

Local treatments to the throat, larynx, trachea, and nasal passages have been much used, and have consisted of powders insufflated, solutions applied to the throat or sprayed into the passages, and various vapors inhaled.

Of powders, quinine, bismuth salicylate, benzoin, and boric acid have been used, all greatly diluted with some inert substance, as acacia or sugar of milk. They have done some good, but are hardly to be recommended for children, who generally are frightened by them. Probably the best among them is quinine in the proportion of 5 to 10 parts of the hydrochlorate to 10 parts of bicarbonate of sodium and 100 parts of gum arabic, of which a few grains may be used two or three times a day for insufflation into the throat. Good results from the use of these insufflations into the nose are reported.

Among the sprays of value are carbolic-acid solutions ($\frac{1}{5}$ to 1 per cent.), tannin, and bichloride of mercury (1 : 2000 parts). The carbolic acid spray is useful and safe, provided the patient will submit

to it without a struggle. Cocaine solution (2 to 5 per cent.) may be applied to the throat with a brush, but it should be used with great caution and only in an emergency.

Of the inhalations, probably very weak sulphurous acid gas, produced by burning a minute quantity of sulphur in the room, the vapor of the oil of eucalyptus, and the vapor of impure carbolic acid, thrown into the air by the heat of a lamp, are the best of all. The last fulfils the same purpose as the spray of carbolic acid, and is less disagreeable to the patient. The air of the room may be slightly charged with it constantly.

PLEURAL EFFUSION AND EMPYEMA; ABSCESS AND GANGRENE OF THE LUNG.

By A. J. McCOSH, M. D.

PLEURISY WITH EFFUSION.

Etiology.[1]—In considering the etiology of pleurisy with effusion there is a growing tendency to abandon the time-honored classification of pleural inflammation into primary and secondary—the "primary" pleurisies being those brought about through a more or less protracted exposure to cold or else being rheumatic in origin (the *pleuritis a frigore* of the older books); the "secondary" pleurisies being those resulting secondarily from all other causes. If we do not as yet feel disposed to give up this classification entirely, we are at any rate inclined to markedly restrict the number of cases of pleurisy which are to be placed under the first heading.

The reason for this increasing tendency to credit more and more of these so-called "primary" pleurisies to other causes lies in the fact that a careful consideration of the pathological anatomy of these cases, and especially of their subsequent history, has brought out in an unmistakable way a tubercular factor in a large proportion of them. That "exposure to cold," however, is the determining factor in many instances cannot be denied, just as in cases of pneumonia that element often seems to be the exciting cause. Other conditions, however, which are considered necessary for the complete evolution of the lesion, are also present. It must also be borne in mind that a perfectly clear-cut line of differentiation between the dry and the sero-fibrinous forms of pleurisy cannot be clinically made, the existence of small amounts of pleural effusion (following upon a so-called "dry pleurisy") being often unrecognized even by the trained ear, and the introduction of the needle for diagnosis being therefore omitted.

In the present state of our knowledge upon the subject we may

[1] Although the subject of Pleurisy is considered by Dr. Herrick in his article on Pneumonia and Pleurisy, the Editor has thought it best to include in the article of Dr. McCosh on Pleural Effusion such statements as he has to make regarding the etiology of this affection, since the surgical treatment depends largely upon the underlying cause of the effusion.

say that we recognize as etiological factors in the production of pleurisies with effusion the following:

EXPOSURE TO COLD, DAMPNESS, ETC.—The exact way in which this more and more discredited "primary" factor may bring about a state of inflammation in the pleural membrane is not at all settled. The possibility of an actual lowering of temperature of the pleural membrane itself resulting in a corresponding inflammatory reaction on its part, being ruled out by the physiological conditions prevailing in the chest, we are driven to the theory of a reflex vasomotor disturbance caused by the effect of the cold on the surface of the body, and its determination to the pleural in preference to other tissues.

As mentioned above, the cases of this kind are becoming less and less frequent as more researches are made into their subsequent behavior, many showing at a later period a tubercular element. In this connection, however, it should also be borne in mind that we may allow ourselves to be carried too far in this direction and to include under the head of tubercular pleurisies those cases in whom a subsequent tubercular behavior may well be the result of some tubercular infection of a lung already damaged by a primary pleural lesion—certainly a perfectly plausible assumption.

The exact position which "exposure to cold" will finally occupy as a primary etiological factor in the production of pleurisies cannot be defined at present, for it may well be that a primary inflammation from some form of bacterium as yet unrecognized may occur in a previously healthy pleura, which then becomes still further infected from some neighboring tubercular lesion, either by direct contact or through the lymphatic channels.

We do not wish to rule out completely "exposure to cold" as an etiological factor in pleurisies; for the facts that these diseases are more frequent in the winter months and that men are more often affected than women compel us to believe that cold certainly bears some relation to the production of the inflammatory process.

RHEUMATISM.—It is known that rheumatic and gouty patients are rather prone to attacks of pleurisy of varying degrees of severity. Many of the milder cases doubtless escape observation, for unlike the serous membranes in the joints, the pleural membranes cease to be the seat of acute pain as soon as their surfaces become separated by even a small amount of fluid.

As to the actual etiological factor or factors in the so-called "rheumatic" cases we are of course as much in the dark as we are concerning the primary cause of rheumatism itself. Some clinicians are inclined to believe that many of the hitherto so-called "primary pleurisies" are in reality rheumatic in origin (especially when existing on both sides of the chest), even if no other part of the body

present at the same time any evidence of rheumatic disturbance. It is not at all unlikely that many of these "rheumatic" cases may at a later period be classified under other heads, for as yet there has been little if any bacteriological work done upon them.

TUBERCULOSIS.—As will be readily seen from the perusal of the statements just made, the exact limit which should be accorded to tuberculosis as an etiological factor in pleurisies with effusion cannot be positively stated at present. As the result, however, of a large number of careful investigations into the many recorded cases, it can be affirmed that the tubercular factor is an extremely frequent and important one, especially among adults. Some still hold the view that the tubercular pleurisies are not as frequent as is generally stated, and in support point to the many cases of pleurisy with effusion which heal up completely after proper procedures have been carried out. This fact, however, may not prove the absence of the tubercular element, for there are records of numerous cases of tubercular peritonitis which have healed up completely after operative interference.

The tendency to swing into the column of "tubercular" pleurisies almost all those cases of pleurisy which were formerly classified under primary pleurisies *a frigore* has arisen, as has already been stated, not so much from the microscopical findings, cultures, and inoculation results of the exudate, as from their subsequent unmistakably tubercular behavior.

Various authors give various percentages of so-called primary pleurisies which have later on developed tuberculosis. Enough cases, however, have been collected to prove that many of these were undoubtedly tubercular from the start.

The starting-point in these tubercular pleurisies may be from—(*a*) Tubercular bronchial glands. (*b*) Some small, perhaps unrecognized tubercular lesion in the vicinity of the pleura, as a tubercular focus in the lungs, or in the ribs, or in any of the bony structures adjacent to the thoracic cavity, as in the spine, sternum, etc. (*c*) A tubercular focus anywhere in the body, and the smaller and more remote the focus the less chance will there be of its being discovered and brought into etiological relation with the secondary pleurisy.

The most common way in which these tubercular pleurisies occur is undoubtedly by the extension of a neighboring tubercular focus in the lung itself to the pleural layer; the more or less rapid breaking down of that focus being succeeded by the infection of the pleura. The resulting exudate will be either clear or tinged with blood, the latter being the result of a slight hæmorrhage from the ulcerated tubercular focus or from the intensely hyperæmic pleural membrane in its first stage of congestion.

The microscope does not as a rule find the tubercle bacilli in the

pleural effusion unless some tubercular lesion has broken down and discharged its contents into the pleural cavity. The fluid, though apparently sterile, will, when injected into healthy guinea-pigs, produce tubercular inflammation in a certain number of cases.

Traumatism.—This is a not infrequent cause of pleurisy with effusion. As a rule, however, the inflammation or rather hyperæmia, does not proceed beyond the formation of a fibrinous or slightly serofibrinous exudate unless some septic element be introduced. Thus we see that many patients even with extensive fractures of the ribs escape with a comparatively slight pleurisy at or near the site of the fractures, whereas an infected compound fracture in the same locality will be followed by the formation of a liquid exudate which will subsequently become purulent.

If there be a traumatic lesion of the thoracic duct true chyle may be found in the effusion. This must not, however, be confounded with the fluid obtained in pleurisies associated with either cancerous or tubercular processes of the pleura, the latter containing broken-down leucocytes, epithelial cells, crystals of cholesterin, etc., whereas the former is seen under the microscope to consist simply of a fat emulsion, the chyle itself.

Sepsis is a common cause of pleurisy with effusion. The lymphatics of the pleura are very prone to transmit any septic element from surrounding or even remote foci. Thus we find a pleural exudate forming from an osteomyelitic process in some one of the long bones of the body as well as from an abscess in a more immediate neighborhood, as that of the chest-wall.

An acute axillary adenitis is not uncommonly followed by a septic pleurisy, the starting-point having been perhaps some apparently insignificant wound of the fingers, hand, or forearm, the lymphatic glands having failed to completely arrest the progress of the germs on their march along the lymphatic route. In a similar way an ulcerating process in a carcinoma of the breast is often followed by a pleural exudate.

Septic processes in the abdominal cavity form a frequent source of pleural effusion, the lymphatics of the pleura communicating freely with those of the peritoneum by means of the lymphatic vessels in the diaphragm. Thus septic processes in the subphrenium are particularly prone to infect the pleura at an early date, such as abscesses of the liver, breaking-down carcinomatous masses about the stomach, or perforating gastric ulcers, echinococcus cysts of the liver; or the infection may come from a still more remote source, an appendiceal abscess.

The pleural exudate may represent the result not of the transmission to it of the germs by the lymphatics from a local septic focus in the vicinity or at a distance, but rather the transmission to it of

germs by the blood in the course of a general septicæmia, all the serous membranes sharing, perhaps, alike in the process. This condition is found in the so-called septico-pyæmic cases.

Among the septic pleurisies we may perhaps place with propriety those pleurisies arising from influenza, though the specific germ has not been found and isolated in all cases. We may also place under this heading those pleurisies which result from septic processes of the tonsils or other tissues, and those occurring with the various exanthemata, measles, scarlet fever, and with whooping cough, typhus fever, retro-pharyngeal abscess, etc. In the exanthemata the poison is doubtless conveyed by the blood. Here also may be included those pleurisies arising as the result of the typhoid bacillus.

The Direct Extension of a Neighboring Inflammatory Process.—Many of the sources of this kind have already been mentioned in the previous paragraphs. Such an extension to the pleural membranes almost always occurs in a pneumonia, the amount of effusion between the layers of the pleura varying, of course, with the intensity of the pneumonic process. In these cases in the aspirated fluid are found—Fränkel's diplococcus; the staphylococcus pyogenes, or the streptococcus, or the fluid may be sterile.

As will be seen later when speaking of empyema, most of these meta-pneumonic pleurisies occur in children.

The inflamed pericardium may be the starting-point of a pleurisy by extension. This is rather the rule, for a certain amount of pleurisy is found to exist in every case of pericarditis.

Syphilis.—This disease seems to be a cause in certain cases. It is certainly uncommon in this country as a sole and distinct etiological factor. French authors specially describe a "secondary" and a "tertiary" form—the secondary form occurring seemingly as a part of a general infection, the tertiary one rather as a pleurisy by extension from some neighboring tertiary lesion.

Endocarditis; Nephritis; Cirrhosis.—As a rule the fluid accumulated in these cases is rather a serous transudation into the pleural cavity due to a local *venous stasis*, and represents a general dropsy. This dropsical fluid contains a smaller amount of albumin and is therefore less coagulable. The transudation is usually bilateral—the amount in each chest, however, oftentimes varying considerably. A similar venous stasis may exist from the pressure of tumors in the vicinity, as of the mediastinal glands.

Changes in the composition of the blood may also give rise to this serous transudation.

Pneumothorax.—The presence of air in the pleural cavity may act as the exciting factor and a sero-fibrinous exudate result.

Tumors of the Pleura.—The small fibromata which are not

uncommonly seen in the pleura do not appear to excite the pleura to inflammation by their presence. This is not the case, however, with malignant tumors, which usually occur from—(*a*) Direct extension of similar tumors of the lungs (these lung-tumors being themselves often secondary to similar tumors elsewhere). (*b*) Metastatic nodules from malignant tumors of other organs (*e. g.* carcinoma mammæ, osteo-sarcoma of femur, etc.). (*c*) Some are primary new growths; such are endothelial carcinomata, which are rare. (*d*) Parasitic growths such as echinococcus and actinomycosis. In the latter the tendency is to adhesions rather than fluid.

Hæmorrhagic infarction of the lung—often occurring from the plugging of a terminal pulmonary arteriole. The inflammation is therefore a cortical one and the pleura is soon invaded.

Abscess and Gangrene of the Lung.—The cases occurring from these causes may be due either to sepsis or to invasion by extension through the lung-tissue. A *distinction* should be made between—(*a*) A blood-effusion into the pleural cavity (hæmato-thorax) and (*b*) Pleurisy associated with a blood-tinged exudation.

(*a*) In *hæmato-thorax* the etiological factors are—(1) Traumatism, as from fracture of ribs, where the pleura and even the lungs may be lacerated and the blood comes from a ruptured vessel. (2) The bursting of a blood-vessel in the neighborhood, such as an aneurism of the aorta or from a vessel in a carcinomatous or sarcomatous tumor, the tumor, however, not having encroached sufficiently on the pleura to cause an exudate. (3) The pressure of a tumor on the large intrathoracic veins.

(*b*) As causes of the *blood-tinged exudation* in a pleurisy with effusion may be mentioned—(1) The ulceration of the walls of a blood-vessel in or near the pleura in an ulcerating tubercular lesion. (2) The hyperæmic condition of the blood-vessels in the pleural membrane in cases of intense congestion at the outset of the inflammation. (3) Septic disease as a result of the embolic affections of the lungs. (4) Cases of scurvy and of purpura hæmorrhagica. (5) The general hæmorrhagic diathesis (when associated with pleurisy with effusion). (6) Pernicious anæmia and leukæmia.

Treatment.

The treatment of pleurisy is practically the same as was so fully and clearly described in Volume II. It will not be amiss, however, to add what has been learned by the experience of the past five years.

Medical Treatment.—It is important if possible to ascertain the cause of the pleurisy and direct our attention toward its removal. For example, in rheumatic subjects the administration of anti-rheumatic medicines such as sodium salicylate, oil of wintergreen, or salophen is indicated. In addition to treatment of the cause, rest

in bed, fluid diet, and strapping of the chest, and perhaps tincture of aconite should be employed in the acute stage before the effusion has appeared. In regard to counter-irritation opinions differ and will continue to differ.

In the *stage of effusion* the two indications are for depletion and aspiration of the fluid.

DEPLETION.—The dry diet seems to be more useful in restraining the exudate than does the fluid diet. The amount of fluids drunk should be restricted as much as possible. If fever is absent or only slight, a diet of meat, dry bread, and eggs should be employed, with a limitation of the fluid to eight or ten ounces in the twenty-four hours. Every morning an hour before breakfast a saline cathartic, as half an ounce of Epsom salts, should be given. The urine should be watched, and, if scanty, diuretics such as the potash salts may be given with advantage. The skin must also be kept active. Other indications must be met by appropriate remedies.

ASPIRATION.—It was formerly the custom not to aspirate as long as fever was present unless pressure-symptoms were marked. It was also formerly the custom to wait at least three weeks before removing any of the fluid. Modern practice, however, is not influenced by those considerations and aspiration is now employed irrespective of fever and irrespective of any certain duration of the disease. Thoracentesis is always indicated—

(*a*) When the fluid is sufficient to cause dyspnœa.

(*b*) When the fluid reaches as high as the third rib, whether or not there be symptoms of pressure.

(*c*) When the heart is displaced by the pressure of the fluid.

(*d*) When the fluid resists absorption for longer than two weeks in spite of medical treatment.

Another indication which is observed by many physicians, but which is not absolute, is to aspirate when the level of the fluid rises above the angle of the scapula.

As already stated, fever should not be considered a contraindication to aspiration. Not infrequently after removal of a part of the exudate the temperature will at once fall never to rise again.

The old idea that aspiration occasionally caused the conversion of a clear effusion into a purulent one is at the present day abandoned. Possibly in former times an unclean needle or syringe may have produced such a result, but at the present time such an accident would be inexcusable and any fear of it may be dismissed from our minds.

The advantages of early aspiration are that adhesions may be prevented and the course of the disease shortened. This latter is especially true in regard to children, in whom rapid cure is apt to follow a single aspiration.

The *diagnosis* of pleurisy is not complete without the use of the exploratory puncture. With ordinary caution this should be absolutely harmless. An ordinary hypodermic syringe is not well adapted for this purpose. The needle is too short and of too small a calibre, and the great difficulty of disinfecting a leather piston should exclude the use of this instrument. There is but little excuse for its employment when so many syringes capable of sterilization can be found. It must be mentioned, however, that until recently it has been difficult to find a syringe possessing a good power of suction and at the same time capable of sterilization by boiling. A variety of syringes can, however, now be recommended for this purpose. The piston of some is made of asbestos; the best of these are the Overlach and Meyer instruments. In the larger syringes, however, the asbestos is apt to flake off. A better instrument, which is made of any dimension, is the syringe of Baumgartel, in which the piston is made of linoleum. An admirable syringe is that invented by Wülfling Lüer, consisting of a smooth rod of glass within a glass cylinder. Serviceable instruments are now being constructed in this country in some of which a solid metal rod acts as a piston, in others the piston being made of rubber.

It is of the utmost importance that the skin be carefully disinfected before the puncture is made. A thorough scrubbing with green soap followed by alcohol, ether, and bichloride solution should invariably be made. The syringe should be removed with sterilized hands from the vessel in which it has been boiled in a soda solution. The needle should not be plunged in, as is sometimes directed, but it should be slowly and steadily pushed through the chest-wall until by the free oscillation of its point it can be determined that a cavity has been entered. This is generally at the depth of about two inches. The needle used for this purpose should be at least three inches in length.

Should the ordinary hypodermic syringe be used, a prior disinfection must be done by soaking it for at least twenty minutes in a solution of carbolic acid, 1 to 20. When removed from this by sterile hands it is not ready for use until it has been washed out with *sterile* water, for as a rule a culture should be obtained from the fluid withdrawn by the syringe, and enough of the carbolic will remain to destroy the germs in the fluid.

The diagnosis having been made and thoracentesis being indicated, the aspiration can be made by one or other of the aspirating syringes described in Vol. II. The instrument, however, should invariably be tested before the needle is introduced. There is no better instrument than the ordinary Dieulafoy aspirating syringe with double stop-cocks. The needle used should have a diameter of at least 1 mm. and be at least three and a half inches in length. The whole apparatus must be carefully sterilized before use.

The use of the trocar and canula has been abandoned as unsatisfactory.

The *amount of fluid withdrawn* must be regulated by the condition of the patient, but the chest should never be entirely emptied, even were this possible. The needle should be withdrawn at once when cough begins, or when the patient experiences dyspnœa or faintness, or when the heart's action becomes weak or irregular.

If during the aspiration the needle becomes plugged by clots of fibrin a sterile stylet should be inserted through the needle. If this fails to clear away the obstruction fluid should never be syringed back through the needle, but the needle should be removed and inserted at some other point.

After use the syringe and all its attachments should be thoroughly cleansed with hot soda solution.

Frequently, especially in children, a single aspiration will be at once followed by improvement which will continue. A second or even a third aspiration may be needed, and even then the fluid may re-accumulate. In such cases when the pleurisy may be said to be chronic the indications are for a free incision and drainage, the details of which are discussed under Empyema. Of course, in hydrothorax that is due to chronic heart- and kidney-disease these remarks do not apply, as in such cases repeated aspirations must be employed until the original disease has either been cured or has ended fatally.

Empyema.

Etiology.—For the production of an empyema the pus-producing microbes must be present. The inflammation (*a*) may be purulent from the start, or (*b*) a pleurisy with effusion may be converted into an empyema by the addition of the pyogenic bacteria.

The pus in empyema is not made up simply from the white blood-cells which have come through the walls of the blood-vessels by diapedesis, for their numbers are far too great for that to be possible. These cells undoubtedly subdivide rapidly after escape from the blood-vessels.

In enumerating the etiological factors of empyema we cannot do better than to say that they are much the same as those mentioned under pleurisy with effusion, the empyema being simply a further stage in the same process, whether the pus be produced from the start as a result of infection with pyogenic organisms or whether it be due to a later infection engrafted on a sero-fibrinous exudation.

The germs found are—Diplococcus pneumoniæ (Fränkel's). Streptococcus pyogenes. Staphylococcus pyogenes aureus. Tubercle bacillus. Typhoid bacillus. Colon bacillus. (A few others in rare cases.)

Diplococcus Pneumoniæ (Fränkel's).—This germ is found in a large

proportion of meta-pneumonic empyemata. Most of the purulent pleurisies in children (about 75 per cent.) are meta-pneumonic. This germ is short-lived and is not very virulent, hence most of the empyemas in children are more easily cured than is empyema in adults. It is found in a certain number of cases of empyema where no lung-lesion can be discovered. This does not, however, rule out absolutely the evidence of a previous pneumonic process, for in children—a class in which a large proportion of these cases are found—a central pneumonic process not easily diagnosed often occurs. This has doubtless been the case in many of the patients above referred to, and the presence of the pneumococcus is the only guide to the etiological factor. The exact route taken by this germ on its way to the pleura has not as yet been clearly proven ; the lymphatics, the lung-tissue, or the blood-current may be the route chosen. There is nothing unreasonable in the assertion that the germ may travel into the pleura and there set up a pleurisy without causing any pneumonia along its path. The pleural membranes may happen to be a more suitable soil for its development at that time than is the pulmonary tissue.

This bacillus is found in about one-third of all cases of empyema. It often, but not invariably, produces a thick, viscid pus of greenish tinge.

Streptococcus Pyogenes.—This germ is found in about one-half of all cases of empyemata in adults. The streptococcal empyemata are clinically of much more severe type than the pneumococcal. The influenza cases seem to come under this group where the streptococcus is found in the pus. When the germ exists in the purulent fluid it has probably in many cases been carried to the pleura from a primary focus in some other part in the body. This primary focus may well be overlooked, especially if it be small and in the lungs. As a starting-point for the germ, some one of the various lesions mentioned as etiological factors in pleurisy with effusion may sometimes be discovered if the patient is carefully examined.

This germ is found as the chief factor in certain pneumonias following the infective diseases. In many cases this is doubtless the source from which it enters the pleural cavity.

Staphylococcus.—A few cases are recorded where this germ was found in pure cultures of the pus. As a rule, however, it is found together with other germs, so that we cannot at present definitely gauge its exact etiological importance. Usually in such cases the other forms of associated bacteria determine the quality of the inflammation and the properties of the purulent fluid. This germ also, doubtless, comes from the lungs, as we find it there in some cases of lobar and of broncho-pneumonia.

It was formerly supposed, when a previously clear pleural effusion

became purulent as the result of aspiration, whether for diagnosis or for treatment, that this effusion had been infected either directly from the needle or from the germs in the air reaching the pleural cavity through the wound. We know now that while this may of course occur, still a certain number of these effusions will become purulent if left to themselves. The pyogenic germs doubtless reach the fluid either through the inspired air or through the blood-current. The danger of infecting the pleural exudate even when an unclean needle is used is not very great, as usually the exudate possesses sufficient germicidal properties to destroy a small number of germs.

Bacillus Tuberculosis.—While this germ figures strikingly as the etiological factor in a large percentage of pleurisies with effusion, we know that it is found in but a small percentage of all cases of empyema. While the germ, however, is *found* microscopically only in a few cases, the results of inoculation experiments prove that apparently sterile exudates are in reality tubercular. At the present time the withdrawal of absolutely sterile fluid from an empyema places the case clinically among the tubercular ones.

The tubercular cases are usually chronic, resulting in great pleural thickening which under the microscope shows typical tubercular inflammation. The pus is often thin, and may be streaked with blood, and is rather grayish as distinguished from the green pus of the metapneumonic cases.

For the sake of completeness may be mentioned as occasional factors—(*a*) The *encapsulated bacillus of Friedländer*, and (*b*) The *typhoid bacillus*. The inflammation set up by the typhoid bacillus is more apt to be a pleurisy with effusion, which may well become infected at a later period by one of the other micro-organisms from some septic focus elsewhere in the body.

The Saprogenic Microbes.—These are the microbes which add to the effusion the element of putridity or gangrene. Among them we note *Löffler's bacillus; Bacillus coli communis; Leptothrix.*

A gangrenous pleurisy may be either gangrenous from the start or the gangrenous element may be added secondarily and determine its putrid quality. Any focus containing the gangrenous elements may become the source of the gangrenous pleurisy. Such a focus may exist in the gastro-intestinal tract anywhere from the pharynx to the anus, as in a carcinoma of the œsophagus, stomach, or intestine, or suppurating processes about the intestines.

In the lungs, bronchiectatic and phthisical cavities which have become gangrenous are within easy reach of the pleural lymphatics.

Breaking-down hydatid cysts may also furnish the gangrenous element.

Treatment of Empyema.—The diagnosis having been established by an exploratory puncture, the pleural cavity must be opened and drained as soon as possible. Aspiration is useless. The use of the trocar and canula is not advisable. Continuous siphon-drainage such as Bulau's is inconvenient and inefficient in the majority of cases. The case must be treated as one of ordinary abscess and the pleural cavity must be freely opened.

When prepared to operate, the rule should always be observed to make an exploratory puncture with an aspirating needle at the point where the incision is to be made, and not to begin the operation until pus has been found.

As a rule the patients will need an anæsthetic. Occasionally, if no excision of rib is required, the operation can be performed under cocaine. Anæsthetization should never be profound.

Opinions differ as to the best spot at which to make the opening. It is not essential that the pleural cavity should be opened at its lowest part, though it is of advantage to do so. The seventh interspace at the mid-axillary line or the eighth interspace at the angle of the scapula is generally chosen.

When the patient is anæsthetized care should be exercised not to roll him too far over on the sound side, as there is danger of compressing the uncrippled lung. A slight tilting by sand-bags under the back will suffice.

Shall a simple incision be made, or shall a portion of a rib be excised? On this point opinions differ. In children it does not seem, as a rule, necessary to remove any part of a rib. A simple incision and drainage for a week or so will generally be sufficient to effect a cure. It may be stated, therefore, that in ordinary cases of empyema in children a simple incision is all that is necessary. If a cure does not result from this a portion of rib can be removed at a later date. In adults, however, the best practice seems to be to remove an inch or more of the seventh or eighth rib. The opening thus obtained will secure better drainage, will probably shorten the course of the disease, and will also permit of a digital inspection of the lung and pleural cavity. Many cases, however, will recover promptly without the removal of the rib, and it cannot be laid down as an absolute rule that a portion of the rib must be excised.

The fluid should be allowed to escape slowly.

In chronic cases, however, of long standing a portion of one or more ribs should always be removed.

Irrigation, as a rule, should not be employed at the time of operation. It is a good rule never to employ irrigation when the patient is fully under the influence of an anæsthetic. More than one death has been caused by neglect of this rule. In cases, however,

where the pus is foul, or where there are present large masses of fibrin, or where the costal pleura is coated with tough and thick layers of lymph, irrigation is indicated. The fluid employed must be hot and should be normal sterile salt solution. There is no advantage in the use of antiseptic solutions, and the pleura absorbs so rapidly that there is some danger of systemic poisoning. While the irrigation is being employed the patient should be allowed to partially recover from the influence of the anæsthetic.

The elaborate plans of drainage are useless. A simple rubber drainage-tube with a calibre of half an inch inserted just within the pleural cavity is all that is needed. Care should be used to fasten it externally by a large safety-pin or suture so that it may not be sucked into the chest and cause a permanent fistula, and perhaps a suit for malpractice. The sterile dressing of gauze and cotton should be abundant so that it may absorb the discharge, act as a valve in preventing the entrance of air into the pleural cavity, and at the same time exclude infection from without.

The risk from the operation itself is trifling. The most dangerous part of it is the anæsthetic. It should be most carefully administered and but a small amount should be employed.

After-treatment.—For the first forty-eight hours after operation the patient should be allowed to remain quiet on his back. Systematic changes of position which will enable him to empty the pleural cavity must then be begun. He must be raised up and turned over on the diseased side several times daily and later may be encouraged to hang over the side of the bed with the hands resting on the floor. Efforts should be made to cause the lung to expand. Deep inspirations should be taken. If this fails a series of gallon bottles filled with water should be used (Woulff's bottles), the patient transferring by air-pressure the water from one bottle to another.

As a rule, no irrigation is needed. In favorable cases the tube can generally be removed at the end of ten days or a fortnight and the wound will be closed in from three to five weeks. When the case has been of long standing or when the pus is foul, daily irrigation with salt solution may be necessary. In these cases the duration of the opening may be months instead of weeks. In 46 cases collected by Runeberg the average time of healing was forty-eight days. In the 61 cases of Borivert it was forty-nine days (in 21 of these cases it was less than four weeks). In cases of long standing, especially in elderly patients where the ribs are very rigid and the cavity of large size, the chances of cure without further operation are not very favorable. In recent cases, however, especially in the young where the ribs are elastic and the cavity not too large, the chances of rapid cure are excellent provided the tubercular element be absent.

Should a profuse discharge continue for longer than seven or eight weeks without sign of decrease it is generally an indication that more radical measures may be needed. One of the simplest of these is the insertion of strips of gauze into the pleural cavity, which is thus packed as would be any other granulating cavity. A mild iodoform gauze may be used, but a careful watch must be kept for iodoform-poisoning. The gauze should be removed and the cavity irrigated and re-packed every third or fourth day. If a successful issue is to be expected, the external opening must be large. Benefit will occasionally be derived from this plan of treatment, but too much must not be expected from it.

COMPLICATIONS.—If the operation has been properly performed, the dangers of sepsis should be almost *nil*. If, however, it should develop, a freer opening must be made and frequent irrigations should be employed.

Another possible complication is abscess of the lung or brain.

Excoriation of the skin about the opening will sometimes be produced by the irritation of the discharge. A frequent change of dressing and the application of a bland ointment, as vaseline with 10 per cent. boric acid or the ointment of zinc oxide, will produce relief.

Suppuration of the chest-wall around the opening may occur. This may need free incisions. Caries of the ends of the rib may also result. Removal of the diseased bone will then be necessary.

In a considerable proportion of cases a permanent fistula will result leading into a large cavity which the lung cannot obliterate by its expansion. If at the end of several months there is no sign of its obliteration, one of the thoraco-plastic operations should be performed. Schede's operation, while more severe, seems more effectual than Estlander's. Its advantages consist not so much in the larger amount of chest-wall removed as in the removal of a large area of diseased pleura. The incision is begun at the outer edge of the pectoral muscle about the fourth rib and carried downward in a curved direction to the lower part of the pleural cavity, extending backward as far as the tenth rib in the post-axillary line. It is then carried upward along the vertebral border of the scapula (which is drawn forward by placing the arm across the chest). The large skin-flap, attached above, is then raised and a subperiosteal resection made of all the ribs between the second and ninth, from the junction of the rib with its cartilage in front to the tubercle behind. The rib is best divided by bone-forceps near the middle, the ends drawn outward and broken off at the points above mentioned. The thickened pleura and the intercostal muscles are then cut away. The skin-flap is let fall into place and sutured. Many months must elapse before a cure can be expected from this severe operation.

ABSCESS OF THE LUNG.

Etiology.—The exciting cause of a pulmonary abscess is the same as that of a suppurating process in any other part of the body, *i. e.* the presence of the pyogenic bacteria, generally the streptococcus or staphylococcus. These germs either gain access to the lungs through septic emboli from a more or less remote focus of suppuration, being conveyed by the blood or lymphatic current or by means of the inspired air. If the infection has been carried by the latter channel, the vitality of the affected portion of the lung must have been lowered by previous disease or by injury. When the infection is conveyed in the blood or lymph-channels a portion of a perfectly healthy lung may break down into an abscess.

If the infection be brought to the lungs by an embolus, this embolus is usually arrested in one of the pulmonary anterioles, and consequently is apt to lodge near the surface and shut off the blood-supply from a wedge-shaped portion of lung. There results a hæmorrhagic infarct which, becoming infected by the germs in the embolus, softens and is converted into an abscess. If in addition the germs of putrefaction gain access to this broken-down area, there results a spot of gangrene. A septic process anywhere in the body may be the starting-point of such an embolus; for example, a septic uterus following childbirth; sloughing bed-sores; suppurating joints; broken-down mediastinal glands; malignant pustule; glanders; carbuncles and boils; otitis media; a suppurating cancerous mass; an ulcerating appendix; an osteo-myelitis, caries or necrosis of any of the bones especially about the thorax; abscess of the liver.

Any infected wound of the skin, which may have healed superficially, can also furnish the septic element necessary.

Before the introduction of the aseptic methods in modern surgery the wounds made by the surgeon were not infrequently the starting-points of septic processes in various parts of the body. The lungs, being naturally the first organs to arrest the septic emboli, were not infrequently the seat of abscesses thus formed. These cases are but very rarely seen at present. Operations upon some diseased portions of the genito-urinary tract are, however, followed even now at times by the production of an abscess of the lung.

The heart itself may be the source of infected emboli; the pyogenic germs which have attached themselves to the damaged valves or to the vegetations upon these valves, or to the walls of the ventricle in their neighborhood, may be swept away by the blood-stream, to be subsequently lodged in the terminal arterioles. This occurs in cases of malignant endocarditis.

In punctured and bullet-wounds of the lung the pyogenic germs

may have been carried in by the weapon or the bullet, and then find an excellent soil in the lacerated lung-tissue, which subsequently becomes converted into an abscess.

In cases of empyema also, especially if the inflammation be of a severe grade, the lymphatics of the pleura and lung may become so choked with the pus as to undermine the lung-tissue itself, which becomes soft and finally breaks down into an abscess.

In some cases of pneumonia spots may remain from which the exudation has not been absorbed. Pyogenic germs are conveyed to these areas either through the inspired air or through the blood or lymphatics, and an abscess is the result.

As an etiological factor traumatism of the chest must be mentioned, with a resulting contusion of the underlying lung-tissue or even a rupture of a portion of it. This may well be followed by infection of the damaged area and the formation of an abscess.

Small areas of pneumonia from the inhalation of fluids or of solid matter—the so-called inhalation or inspiration pneumonia—may likewise become infected by these micro-organisms and break down.

Abscesses, however, most frequently follow some inflammatory condition of the lung in patients who have been debilitated by long-continued illness or alcoholic excesses. As a rule they do not form in the lungs of the young and healthy unless as the result of traumatism or septic emboli. It is true, however, that occasionally as the result of a pneumonia, grippe, or pleurisy a pulmonary abscess will result even in the young and vigorous. The vital forces of such patients must have been much depreciated by the original disease. The source of infection can often not be determined, but by exclusion the conclusion is reached that it is carried to the damaged area by the inspired air.

The diagnosis is often difficult. It is of importance, however, that an abscess should be differentiated from bronchiectasis, encysted empyema, and tubercular cavities. Apart from the physical signs the presence of elastic fibres or of the tubercle bacillus in the sputum ought to lead to a correct diagnosis as far as bronchiectasis or tuberculosis is concerned. Differentiation from an encapsulated empyema is not of so much importance, as the treatment for both conditions is very similar.

Treatment of Abscess of the Lung.—When the diagnosis of abscess has been made, what shall be the treatment of the case? In an abscess in any other part of the body there can be but one answer to this question, and that answer is free incision, evacuation of the pus, and thorough drainage. A categorical answer cannot be given, however, when the abscess is located in the parenchyma of the lung. It must be qualified, for the successful treatment of such cavities

depends much on the special conditions, both local and general, of each individual case. In certain cases the old rule, *Ubi pus ibi incisio*, must be strictly followed. In others it is of equal importance to ignore this rule. In still others, and this forms the largest class, it is difficult to decide whether or not operation is advisable. It is exactly in cases of abscess that lung-surgery has been most successful. Many satisfactory results have followed operative interference. We know how little can be expected from medical treatment; sufficient surgical experience has accumulated to enable us to intelligently contrast the surgical with the medical treatment of this class of cases.

Medical Treatment.—This will in a measure depend on the general condition of the patient, on the cause of the suppuration, and on the situation and extent of the abscess. In all cases, whatever the cause and whatever the local conditions may be, the indication is for stimulating and supporting treatment. Judicious stimulation and attention to nutrition are of more importance than are drugs or inhalations given for the purpose of exerting an antiseptic action on the abscess-cavity itself. It cannot be denied that benefit may be derived from the use of this class of remedies, as also from drugs which promote free expectoration. The position of the patient is also of importance. The indications will be discussed in the order of their importance.

Stimulation and Nutrition.—The greatest care must be taken to maintain in proper condition the functions of digestion and assimilation. Every effort should be used to prevent any disturbance of the alimentary canal. The expectoration of fœtid sputum is apt to cause gastric disturbances and disinclination to take nourishment. Local measures to be considered in a later section are sometimes beneficial in removing the nauseating odor and taste. It is largely on account of the importance of maintaining the digestive functions in proper condition that care must be exercised in the use of drugs. No general rules can be laid down in regard to the character or amount of either food or stimulants. A moderate use of alcohol in one form or another is generally indicated. As a rule whiskey is best, but brandy or some form of wine may be most suitable in certain patients. Even should the pulse be fairly good a moderate amount of alcohol is indicated. Alcoholic stimulation in any form of sepsis is always of great value. If, for example, the pulse is under 100 and of fair quality, 3 or 4 ounces of whiskey in the twenty-four hours will suffice; but if the pulse-rale is 120 or higher and the heart's action feeble, double or treble that amount may be indicated. Of course the manner of its administration, whether in milk or otherwise, must be regulated by the peculiarities of the case.

In addition to the alcohol it is generally well to give strychnine

either by mouth or by hypodermic syringe, preferably by the latter. The dose should be gr. $\frac{1}{30}$ every three or four hours, or, if the heart's action is very weak, as often as every hour. It is not uncommon for patients to complain bitterly of the frequent hypodermic injections, and in such cases it may be necessary to administer this drug by the mouth, provided that it is well borne by the stomach. Should the arterial tension be high nitro-glycerin may occasionally be indicated, in doses of gr. $\frac{1}{100}$ every three or four hours. Of course other heart-stimulants, as digitalis, strophanthus, etc., may be needed. The bowels should be kept open by gentle laxatives and the action of the kidneys maintained.

ANTISEPTIC AGENTS.—These are general and local.

General.—Drugs are employed whose elimination is partially accomplished through the bronchial tubes. The balsamic drugs, as turpentine, creasote, and tar, are chiefly employed for this purpose. If they could be used freely considerable benefit might be expected, but the stomach generally cries *halt!* The most easily borne is terpene hydrate or terebene in doses of 10 drops four times daily.

Local.—Antiseptics can be administered in the form of sprays, inhalations, and gargles. Of the sprays a 1 per cent. solution of carbolic acid or a solution of thymol 1 : 1000, or a 3 per cent. solution of peroxide of hydrogen, are the most efficient and agreeable. Of the inhalations a combination of creasote (wood), alcohol, and chloroform in equal parts is one of the best, or the formula given on page 658 of Vol. II. may be used. Eucalyptus, either alone or combined with other antiseptics, is one of the most popular local remedies, either in spray or gargle. Any of the antiseptics in weak solution may also be employed as gargles—carbolic acid, boric acid, or peroxide of hydrogen. Some of the semi-proprietary combinations are useful.

It must be acknowledged that medical treatment can be of but little avail. The *vis medicatrix naturæ*, when encouraged by proper food and stimulation of the heart, will accomplish more than drugs.

The most important point in the treatment of pulmonary abscess is the question of surgical interference. Is operation indicated, and if so, when? The decision of this question will depend on three conditions: first, the general state of the patient; secondly, the efficiency of the drainage through the bronchi; thirdly, the absence of general sepsis. Should the patient's general condition remain good, and should there be no marked loss of strength, the operation may be delayed. If on the other hand the strength of the patient should gradually fail, if the pulse should become rapid and feeble, then delay is unjustifiable. Also if signs of sepsis should develop, indicated by an increase in the temperature, a dry tongue, or delirium, immediate operation is demanded.

Proper drainage is essential to recovery. If there is evidence of the ability of the patient to empty the abscess-cavity by the efforts of coughing and maintain it in this state, then operation may be delayed. If, however, the cavity cannot be evacuated and in consequence remains partly filled with the purulent material, there is great danger of general sepsis, and the sooner an external opening is made the better will be the prognosis. The amount of sputum will generally give a fair idea as to the ability of the patient to empty the cavity, but occasionally the patient will swallow the greater part of his expectoration and so mislead the physician. The physical signs ought, however, to indicate the condition of the abscess-cavity.

It seems inexcusable to allow a patient to die from abscess of the lung without an effort being made to save his life by means of a surgical operation. As soon as signs of constitutional sepsis manifest themselves, or if there is evidence that the abscess is spreading, immediate operation is demanded. In cases of doubt it seems safer to operate than to trust to spontaneous recovery. Even cases that seem desperate may be rescued by a rapidly completed operation. A number of successful cases have been reported where it seemed questionable at the moment of operation whether or not the patient was in condition to bear the anæsthetic. The location, nature, and size of the abscess will have some influence in deciding whether or not an operation shall be done. An abscess near the apex is much more likely to drain into the bronchi and heal without operation than one situated near the base of the lung. This must have an important bearing on the decision. When near the base it is well to operate at an early stage of the disease. The chances are that sepsis or pyæmia will result if no external opening be made. It is otherwise with one near the apex. In such cases a certain amount of delay may be safe, but a most careful watch must be kept for constitutional symptoms or extension of the suppurative process.

It is often difficult to differentiate between a pulmonary abscess and an encapsulated empyema which has opened into a bronchus. If in doubt operation is indicated, as, should it be the latter, an external opening is urgently demanded.

The mortality of operations for pulmonary abscesses has been considerable, but in the last few years it has been steadily decreasing, and it will doubtless be still farther reduced now that physicians feel assured that there is a reasonable hope for recovery in any case of pulmonary abscess and an excellent chance for a successful issue provided that the operation can be done before the patient is saturated with sepsis or exhausted by fever. Statistics show that the mortality of operations done within the past three years has been not greater than 20 per cent. In former years it reached as high as 50 or 60

per cent. Trzebicki collected 42 cases which had been subjected to operation prior to 1892. Of these 14 recovered and 24 died, 3 being improved. Reports of more recent operations are, however, much more favorable, as in the 38 cases collected by Fabricant 29 recovered and 9 died, and in the 23 cases collected by Reclus (1885–1895) there were 20 cures and only 3 deaths.

"The nature of the primary disease plays a great part in determining the course of events: 17 cases of abscess after fibrinous pneumonia gave 14 cures and 3 deaths; 7 after specific fevers gave the following results: typhoid, 2 cases, both cured; scarlet fever, 1 case, which died; pyæmia, 4 cases, 3 cures, 1 death; suppurating hydatid cyst, 3 cases, all cured; bullet-wound, 2 cases, both cured. Pneumonia is therefore the commonest cause of abscess of the lung, and operation on abscesses of this character is in the great majority of instances crowned with success" (Reclus). Another quotation from the same author well expresses the views of many surgeons and physicians: ". . . . and may now assert that whenever there is an abscess there ought to be an operation. No need to wait till fever blazes up, till the patient is threatened with septic absorption and his general condition is alarming; one has no right to delay, save perhaps in a case where the abscess is very small, draining easily and readily into the air-passages, or where there are multiple abscesses requiring for their evacuation such mangling of the chest as would not be justified. Happily these latter cases are rare."

Operation.—Incision into pulmonary cavities was advised as long ago as 1710 by Baglivus and others. In 1850 Graux reported 13 unsuccessful cases of operation, and this with other unfavorable reports retarded the progress of thoracic surgery until fifteen or twenty years ago when numerous successful operations on animals raised the hope that similar results might be obtained as the result of intra-thoracic surgery on the human race. Except in cases of abscess, hydatid cysts, and gangrene this expectation has not been realized. In these three conditions, however, the results of operation are very promising.

The existence of adhesions between the lung and chest-wall has been hitherto and unfortunately still is by some surgeons considered a requisite for successful operation. More than one patient's life has been sacrificed on this account. In latter years many successful operations have been performed where there have been no adhesions between lung and chest-wall. While it is not denied that adhesions are of great value, yet they are not essential, and if operation is indicated by the symptoms it should be performed, adhesions or no adhesions.

Before operation it is often difficult to determine whether or not

the lung is adherent. The history of previous pain and the existence of friction-sounds in a case where the abscess is not of recent origin is generally an indication that adhesions have already formed.

Details of Operation.—The first step is to determine the existence of an abscess and its location. This is best accomplished by means of an exploratory puncture with an aspirating needle. Very possibly, however, this may fail to detect the abscess, as the pus may be too thick to pass through the needle or the cavity may be nearly collapsed. The needle used for this purpose must be a large one, at least four inches long and with a calibre of one to two millimetres. An ordinary hypodermic needle is almost valueless. The syringe must be in good order and possess a powerful suction-force. The small aspirating syringe or the large hypodermic syringe which is used for whiskey may be employed. The needle and syringe must be carefully disinfected according to the rules which will be found in the section on aspiration in pleurisy.

The skin of the patient is thoroughly cleansed by means of scrubbing with soap and water, followed by alcohol or ether and a solution of bichloride of mercury 1 : 1000. The probable site of the abscess has been already determined by the physical signs, and the needle is plunged in between the ribs in the direction of the supposed cavity. The abscess, of course, may be adherent and superficial, but generally it is necessary to thrust in the needle for a distance of three and a half to four inches before the cavity is reached.

As soon as the syringe has been introduced it may be determined by the oscillation of the needle that a cavity has been entered. On the other hand, no such sensation may be imparted to the fingers, and on withdrawing the piston no pus may appear in the syringe. The needle should then be removed and inserted at another spot, and so on for three or four punctures until the abscess is found. Even should all the punctures fail to find pus an attempt should still be made to open the abscess by an operation, provided that the symptoms and physical signs point decidedly to its existence. Even should then the cavity not be discovered the abscess may at a later date open into the incision which has been made in its neighborhood.

Considerable information as to the presence or absence of adhesions may be derived from the needle. If a sensation of its passage through thick, tough tissue is felt before it enters a cavity, this probably means the agglutination of the lung to the costal pleura. If, after the needle has entered the cavity, the syringe moves up and down with the respiratory movements, it tends to show that the lung is still unattached. If no such motion occurs it is probable that adhesions exist.

The presence and situation of the abscess having been determined,

the next step is its evacuation. For this purpose an ample opening should be made in the chest-wall at a point which will afford comfortable access to and free drainage for the cavity. As a rule, some point in the mid-axillary region will be found the most convenient; it may be between the posterior axillary line and the outer edge of the scapula, or between the anterior axillary line and the nipple line, but usually the spot selected will be in the mid-axillary line and between the fourth and eighth ribs. A free incision along the rib should be made at least three and often six inches long. The periosteum of the rib is divided, pushed aside with a periosteotome for a space of three to four inches, and that portion of the rib excised with a costotome (bone-forceps). This may give sufficient space, especially if the lung is adherent, but often it will be better to remove a corresponding portion of the rib above or below, and especially is this necessary where no adhesions exist and if an attempt is to be made to shut off the pleural cavity from contact with the contents of the abscess by either gauze-packing or suturing. It must be exceptional where an opening is needed larger than that afforded by the removal of portions of two ribs, each three or four inches long. It may be necessary, however, in cases where no adhesions exist and where the location of the abscess is uncertain, to remove portions of a third or even fourth rib. There is no disadvantage in a large opening, and it may be of distinct advantage if the lung at a later date refuses to expand sufficiently to fill the pleural cavity.

First will be described the method of procedure when the lung is adherent to the costal pleura. As a rule, in such cases the abscess is comparatively superficial and the danger of hæmorrhage is slight. The pleural layers are seen to be thickened, whitish in color, and generally firmly agglutinated. The incision into the abscess can be made without fear of infecting the pleural cavity. It may be opened by knife, scissors, trocar and canula, or cautery. The instrument employed will depend on the individual preference of the surgeon as well as on the location of the abscess. Prior to the incision, however, the operating needle should be again inserted, and, after pus has been found, should be left *in situ* in order to serve as a guide to the abscess-cavity. Indeed, in adherent cases the needle which found the pus before the chest-wall was opened can be left *in situ*, but in non-adherent cases this is inadvisable. With the needle as a guide the knife, scissors, or cautery slowly cuts or bores through both layers of pleura and through lung until the cavity is entered, when the pus runs out—it may be an ounce or so, it may be half a pint or even more. An opening large enough to permit of easy entrance of the finger should be made. As a rule the hæmorrhage is but slight, especially if the cautery has been used, but even after the knife or

scissors it is not alarming, at least so far as actual loss of blood is concerned. If the bleeding is free it may be wise to plug the opening at once with gauze to prevent the entrance of blood into the air-passages. On account of this danger the best instrument for making the incision into the lung is probably the Paquelin cautery, at least if the abscess is deeply situated. The finger is then passed into the cavity and gently swept around, breaking up the friable bands and removing sloughing tissue. Care must be taken not to tear apart bands of any considerable thickness, as in them may be blood-vessels of some size. Careful palpation with the finger in the interior of the cavity should then be made for the purpose of ascertaining if there be secondary abscess. Should soft spots be discovered these must be punctured by finger, scissors, or cautery, so that free drainage into the original cavity may be afforded.

The interior of the cavity should be gently swabbed with bits of sterile gauze on the end of long forceps. No irrigation should be employed. This, at least, is a good rule, as there is danger of drowning the patient with the irrigating fluid, and it certainly should never be employed as long as the patient is fully under the influence of an anæsthetic.

After cleansing the cavity it should be drained by a large soft-rubber tube and by strips of gauze (iodoform or sterile) passed into the cavity and brought out through the opening in the chest.

Second—when the lung is found not adherent to the costal pleura. If, after opening the chest-wall, the lung is seen to move upward and downward with inspiration and expiration, adhesions do not exist and the procedure just described must be modified. That plan is safest whereby the operation is completed in two stages. The older surgeons advised the employment of caustics which were placed in the pleural cavity and allowed to remain for a few days until sufficient inflammation had been excited to cause adhesions between the pleural layers. This, however, is an uncertain and clumsy method. A much safer plan is, after making a large opening by the excision of portions of two ribs, to strip the parietal pleura from off the chest-wall for a considerable distance around the opening so that there may be a considerable area of free parietal pleura which can be sutured to the visceral layer.

The pleural cavity is then cautiously opened and the lung quickly seized, before it has collapsed, with forceps, and while thus held the flap of the parietal pleura is sutured to the lung with catgut carried in a curved needle. If the incision into the abscess can be delayed for a few days, a few sutures will suffice, gauze being packed around the line of suture. If, however, it is necessary to open at once—and this is generally the case—the two layers of pleura should be accurately

approximated by a continuous suture running entirely around that portion of the lung into which the incision is to be made. In this manner the pleural cavity is completely shut off from danger of contact with the abscess-contents. Serous membranes unite quickly, and after a delay of even twenty-four hours sufficiently firm adhesions may have formed to allow of an incision into the cavity without danger of exciting a pyo-pneumothorax. Of course this means a second operation, but the incision into the abscess-cavity can often be made without an anæsthetic, or perhaps with the aid of a few whiffs of chloroform. It is rare that a longer delay than twenty-four hours is advisable, though if it be possible to wait three or four days the adhesions will be more secure. As stated, however, the abscess must generally be opened at once, and thus no opportunity be given for the formation of adhesions. In many cases it will be found exceedingly difficult to unite by suture the two layers of pleura, as the lung may be contracted and adherent to the internal wall of the pleural cavity. In many others the condition of the patient will demand a rapid completion of the operation and will not allow of the time needed for the application of the suture. Under these circumstances the pleural cavity must be protected by gauze compresses and sponges from contact with the pus.

If the pleural cavity should, during the operation, have become infected, it is perhaps wise to make a second opening near its base and insert a tube for drainage and irrigation.

The external dressing, which ought to be abundant, will probably be thoroughly saturated in twenty-four hours and should be changed. The gauze with which the abscess-cavity was packed should, as a rule, not be removed for at least forty-eight hours or longer. There will generally be considerable fœtor and it is wise in this case to gently irrigate the abscess-cavity with salt solution, and if necessary the pleural cavity as well. The dressing after this, for a time at least, should be removed every forty-eight hours. The cavity usually closes rapidly, and the packing and tubes can soon be dispensed with.

Hæmorrhage after operation, both from the wound and through the bronchi, is often a troublesome and sometimes a dangerous complication. The treatment should consist of absolute rest with perhaps inhalations of oxygen, and ice on the chest and by the mouth. These hæmorrhages, however, are apt to continue until the sloughs have been cast off.

If the shock of operation has not been too great the patient ought slowly to improve, though, as a rule, convalescence is tedious. Food and stimulants in abundance, and tonics, with perhaps oxygen, should be given. As soon as the strength will permit an out-door life in a balmy climate should be chosen.

GANGRENE OF THE LUNG.

Etiology.—In considering the etiology of gangrene of the lung it is convenient to recognize two varieties of the gangrenous process—one the so-called "embolic gangrene," where a putrid embolus is carried by the blood-current to the lung and there arrested in one of the terminal arterioles; the other where the gangrenous process is engrafted upon a previously existing lung-lesion.

The bacteria of putrefaction are in all cases the cause of the gangrene. No one specific bacterium has been found. They must have, however, a suitable soil for propagation. This is especially true as regards the gangrene which follows inflammatory conditions of the lung. The air-passages constantly contain these germs, and a suitable culture-bed seems only to be found in individuals whose health has been undermined by illness, alcoholic excesses, or bad hygienic surroundings. The white blood-cells of such patients seem to be lacking in phagocytic power.

The poisonous embolus may have its origin in a putrid process in any part of the body, a sloughing bed-sore, an osteomyelitis, a malignant endocarditis or a septic process in the female sexual organs. Necrotic areas of suppuration about the thorax, larynx, or œsophagus are a fruitful source of gangrenous emboli on account of the easy access from these parts to the lungs. Indeed, spots of broken-down tissue in any part of the body may be the source of these emboli. As a rule they lodge near the surface of the lung and the affected area is at first wedge-shaped.

Foreign bodies which, entering the larynx, lodge in a bronchus are a not infrequent cause of gangrene. Coins or particles of food which have "gone the wrong way," or have been regurgitated from the stomach, have been recorded as exciting causes. After an accident of this sort a zone of inflammation is gradually set up around the foreign body at the site of its arrest; the putrid bacteria gain access to this area and a certain amount of gangrene of lung-tissue is the result. The prognosis in such cases is not always unfavorable, because the foreign body, released from its position by the disintegration of the surrounding bronchial wall, may be coughed up together with the gangrenous lung-tissue.

Hæmorrhagic spots the result of contusions of the lung or the damaged areas around the track of a bullet or a sharp penetrating instrument may become infected by putrid germs conveyed in the inspired air. The areas of atelectasis in broncho-pneumonia may become similarily infected.

Diabetics seem especially prone to develop gangrene, due to the feeble resisting power of their tissues. In the insane the direct cause

of the inhalation pneumonia which results in gangrene may often be the paralysis of the muscles of deglutition. This is seen especially in cases of bulbar paralysis.

Fœtid bronchitis is perhaps the most common cause of gangrene. The process spreads from the bronchi to the alveoli, and small portions of the gangrenous lung may be expelled in the expectoration. The differential diagnosis between these two diseases is apt to be very difficult. The fœtid bronchitis is very often the forerunner of gangrene, and the transition from one to the other may be gradual and insidious. The diagnosis "fœtid bronchitis" has doomed more than one patient to death where a timely operation might have been followed by a different result. In fœtid bronchitis there is apt to be a larger amount of thin, watery secretion with a sweetish putrid odor perhaps lighter in color and less stinking than in gangrene, where the expectoration is inclined to be darker and resemble sloughing broken-down tissue. Too much reliance, however, should not be placed on such distinctions.

The differential diagnosis of gangrene from bronchiectasis or an empyema with a bronchial fistula is also often attended with difficulties.

A tubercular process which has become infected secondarily by the pyogenic bacilli must also be distinguished from gangrene.

In reaching a diagnosis the history of the patient is often of great value. This, with the physical signs and the character of the expectoration will generally lead to a correct diagnosis. The presence of elastic fibres in the sputum ought to exclude bronchiectasis, and when tubercle bacilli are found the diagnosis of pulmonary tuberculosis is reasonably certain. In gangrene there may be almost an entire absence of expectoration, and the stinking breath, with the physical signs, must in such cases suffice for a diagnosis.

The distinction between circumscribed and diffuse gangrene is of great importance both as regards prognosis and treatment. In the circumscribed there may be one or several foci. In diffuse a whole lobe or the whole lung may be affected. The process at first may be circumscribed and later become diffuse. Fortunately the circumscribed form is of more common occurrence than is the diffuse.

Prognosis.—A certain number of cases recover without operation. The mortality, however, is at least 75 per cent. The mortality of cases subjected to operation is considerably lower, and doubtless were the patients sent to the surgeon at an earlier date the prognosis would be still less unfavorable. Many patients have been kept under medical treatment until practically all chance for recovery is past, and as a last resort are handed over to the surgeon. What chance can there be for such patients from any method of treatment? In spite of this the operative mortality has been less than 40 per cent. Heyd-

weiller collected 40 cases operated on prior to 1892. Of these 22 recovered, 14 died, and 4 were improved. Reclus reports on 14 cases operated on within the past ten years with only 2 deaths, 11 having been cured and 2 improved.

As in pulmonary abscess the prognosis will vary considerably according to the cause of the gangrene. Take, for example, the statistics collected by Fabricant concerning 26 cases: 6 cases after acute fibrinous pneumonia, 4 cured; 4 after purulent bronchitis, 2 cured, 2 relieved; 1 after inflammation of the mastoid, cured; 2 after foreign body in the air-passages, both died; 2 after bronchiectasis, both died. The prognosis, however, must always be extremely grave. This is due as much to the wretched general condition of these patients as to the local lesion. While a few cases of undoubted gangrene have recovered without operation there is an element of doubt as to the correctness of the diagnosis in many of the cases reported as cured by medical treatment.

Treatment of Gangrene of the Lung.—Much that has been written in the previous section concerning the treatment of pulmonary abscess will apply to gangrene. Attention to the nutrition and proper stimulation of the patient is of prime importance. Balsamic drugs and antiseptic inhalations are also beneficial. When the diagnosis of gangrene has been certainly made, the important question of operative interference will at once arise. In many cases this is, of course, out of the question. When from the start the gangrene is diffuse, involving the greater part of one lung, operation cannot be recommended. In such a case the one indication is to keep the patient as comfortable as possible. In others the general condition or the complicating diseases contraindicate operation.

It is different, however, when the process is circumscribed and the patch is single and comparatively limited in extent. The patient, if young and in fairly good health, may recover without operation, and in such a case it may be advisable to wait, provided there are no signs of general sepsis or of spread of the process. Both these dangers, however, are very great, and it is a question whether or not even in this class of patients early operation would not be the safest plan of treatment. One can never tell when a general sepsis will start up or when a septic embolus may fly to some other vital organ. All may seem to be favorable, and yet in a few hours some irreparable injury has been done.

A number of arguments are advanced why operation should be delayed, the most important, of course, being that the patient may recover without surgical interference. Another is that operation should not be attempted until the stage of consolidation has passed and deliquescence has begun: the answer to this is that in all prob-

ability deliquescence has already begun if the diagnosis of gangrene has been made. Another is that one should wait until adhesions between the lung and pleura have formed. Doubtless these adhesions make the outlook much more favorable, but several successful operations have been performed in their absence, and while waiting for their formation the general sepsis may become so advanced as to exclude later operative procedures. Delay may be fatal.

It is a grave question whether or not it would not be wise to advise operation in every case of *circumscribed* gangrene, unless where from the first the general condition of the patient or intercurrent diseases indicate the hopelessness of any form of treatment. On this point medical men are wavering, and surgeons are inclined to advise more frequent and earlier resort to operative interference. It often, however, seems justifiable to delay operation if the gangrenous patch is small, if the general condition of the patient is good, and if there are no signs of constitutional infection. In patients over fifty such delay, however, seems unwarranted. In any case where operation is postponed a most careful watch for new symptoms or spread of the gangrene must be kept. The patient is on the edge of a precipice, and at any moment a complication may arise which will render the case hopeless.

The operative technique will differ but slightly from that recommended for abscess. The opening should be large, even larger than in cases of abscess. Adhesions are of great advantage, but if not found the pleural cavity must be protected as well as possible. The danger of hæmorrhage is comparatively slight. The incision into the lung is best made by the cautery. This should be used very freely and the sloughing portion perforated in many directions and as much of it destroyed by burning as seems safe. As much of the gangrenous lung-tissue should be removed as possible, provided the condition of the patient permits of a prolonged operation. Generally, however, one must be content with a free incision into the gangrenous patch. Thorough drainage and packing the cavity with strips of iodoform or sterile gauze is necessary.

The shock as a rule is not great, and often within forty-eight hours improvement will be noticeable. The packing should be removed at the end of forty-eight hours and the wound carefully cleansed, gentle irrigation with hot salt-solution being employed. A frequent change of dressing, at least once in forty-eight hours, will be necessary for some time. Convalescence is apt to be slow, and a chronic fistula may result which at a later period may necessitate one of the operations of thoracoplasty. All efforts should be directed toward supporting vitality.

An attempt should be made to disinfect the sputum and to keep the mouth as sweet as possible. As long, however, as sloughing tissue remains in the lung the fœtid expectoration will continue.

PNEUMONIA, CROUPOUS AND CATARRHAL, AND PLEURISY.

By JAMES B. HERRICK, A. B., M. D.

ACUTE CROUPOUS OR LOBAR PNEUMONIA.

There is a quite general belief that croupous pneumonia is an acute infectious disease produced, by local action on the lung, by the pneumococcus. From the primary pulmonary focus there originates a systemic toxæmia producing the constitutional symptoms. In not a few cases there is, in addition, an invasion of neighboring tissues by the pneumococcus, with resulting inflammation—direct infection by continuity—or an escape of the organism into the blood-current, with complicating pneumococcal inflammation in distant organs—metastatic infection. After a certain period, averaging about seven days, there is produced an antidotal toxin, the anti-pneumotoxin (Klemperer), which, overcoming the effect of the toxin, causes the well-known clinical crisis.

This organism, commonly called the *diplococcus pneumoniæ* of Fränkel or the *micrococcus lanceolatus pneumoniæ*, while not answering in every particular the requirements of Koch's laws, is regarded by most bacteriologists as the sole cause of true croupous pneumonia. It is commonly found in pairs, though single forms are also seen, or several cocci are united into a short chain. The coccus is, morphologically, a cross between a coccus and a bacillus. Commonly it is oval, with one end tapering, the blunt end being in apposition with the corresponding blunt end of its fellow. It is not motile and does not form spores. In the tissues and fluids of the animal body and in some cultures the coccus is found surrounded by a capsule. Ordinary aniline dyes stain the diplococcus in cover-slip preparations, and commonly the capsule as well. Welch[1] recommends the following method as a useful one in difficult cases: The specimens, prepared without water, are treated first with glacial acetic acid, which is at once allowed to drain off, and is replaced (without washing in water) with aniline-oil gentian-violet solution. The staining solution is repeatedly added to the surface of the cover-glass until all of the acid is displaced.

[1] *Johns Hopkins Hospital Bulletin*, vol. iii. No. 27, p. 128.

Wash with a 2 per cent. solution of common salt and examine in the same solution.

Particulars as to cultures must be sought in special works on bacteriology. Only certain facts of general interest will be here referred to. The pneumococcus grows with or without the presence of free oxygen—*i. e.* it is a facultative anaërobe. It is very sensitive as regards the reaction of the medium upon which it grows, requiring one that is slightly alkaline. It varies extremely in its cultural behavior, so much so as to suggest the division into different varieties. In cultures it is short-lived. Growing rapidly, it is commonly inert at the end of a week. This fact is suggestive of a partial explanation of the clinical phenomenon of crisis. And it may explain also the comparatively benign course of pneumococcic inflammation in other tissues, as, for instance, in the pleura. An empyema due to the diplococcus is usually relatively mild and amenable to relatively mild treatment. Great variations in the virulence of this organism are found. The cocci, especially in sputum, resist desiccation and retain their virulence for long periods of time. Cases are recorded where after many months the disease has been communicated to the newcomer into the house where the disease had previously prevailed. Thus Schröder [1] reports that from one house there came to the polyclinic at Kiel 32 cases in the fifteen years 1868 to 1892—never less than 1 case, once as high as 6 cases, in one year.

Inoculation experiments show not only great variations in the degree of virulence, but seem to prove the existence of varieties of the pneumococcus. One variety, the fibrinogenic (Foà), produces a true septicæmia, the cocci multiplying rapidly in the blood. It is this variety that was believed to be the cause of epidemic cerebro-spinal meningitis, though recent investigation (Jaeger, Heubner, Fürbringer, Kiefer) seems to prove that a coccus (meningococcus) described several years ago by Weichselbaum, and morphologically not unlike the gonococcus, is the prime cause of this affection. A second variety, the œdematogenic, produces local œdema with toxæmia. It is the variety commonly found in pneumonia. A third variety produces abscess, and is an "exquisitely pyogenic micro-organism." [2] Inhalations of air containing pneumococci, or the injection of cultures into the trachea or lung, have resulted in croupous pneumonia in the lower animals.

These facts concerning the diplococcus may help to explain some of the clinical peculiarities of the disease and to account for the vary-

[1] "Zur Statistik der croupösen Pneumonie," *Thèse*, Kiel, 1882.

[2] Welch, *loc. cit.* This article, though not yet completed, we believe, contains a most thorough review of the knowledge concerning the diplococcus, its history, morphology, cultures, inoculations.

ing results of pneumococcic inflammation. These facts, also, have led some to regard as still open the question as to whether the diplococcus of Fränkel is the sole cause of croupous pneumonia. It is claimed by these that in some cases of croupous pneumonia Fränkel's diplococcus is not found. Claiming that other organisms (Friedländer's bacillus, the streptococcus, and staphylococcus pyogenes) than the pneumococcus may produce lobar pneumonia, they contend for the plurality of the cause against its unity. (Weichselbaum, Jürgensen, Finkler.) Again, there is not always a uniform result from inoculation experiments even when the lungs are directly attacked by the experimentally introduced micro-organism. And, finally, how can a disease of such classically typical course as pneumonia be due to an organism that is found in the mouths of healthy persons, and that produces diseases of such diverse character as meningitis, endocarditis, arthritis, peritonitis, otitis, pleuritis, salpingitis, etc.? The advocates of the pneumococcic origin of every croupous pneumonia contend that if carefully sought for it can be found in every case; that typical croupous pneumonia can be experimentally produced; that differences in virulence, in variety, in environment, explain differences in the results of pneumococcic infection. The position of these men is succinctly and clearly stated by Netter when he says: "The relation between lobar pneumonia and the pneumococcus is to-day no longer questionable."[1] And, again: "There is no pneumonia (lobar) without the pneumococcus."[2] Wherever other micro-organisms than the pneumococcus are present in lobar pneumonia, they are there because of a secondary or mixed infection.

One feels, after studying the bacteriology of pneumonia, that there is much that is not yet clearly understood. The varieties of the diplococcus, its varying degrees of virulence, its different effects in different localities, the pseudo-lobar pneumonias where the diplococcus is not found, offer a rich field for investigation. One is reminded of the analogy between diphtheria and pneumonia. Each is due to the local action of a specific germ, with secondary toxæmia. It is probable that in pneumonia there is a form due to the diplococcus of Fränkel, the true croupous pneumonia, just as there is a true diphtheria due to the Klebs-Löffler bacillus. But there are other forms of pneumonia resembling clinically and anatomically lobar pneumonia. These cases, pseudo-lobar in character, are comparable to the pseudo-diphtheritic anginas that clinically are, at times, indistinguishable from the Klebs–Löffler anginas. Should the use of serum in the treatment of pneumonia prove a success, the question to be decided in an individual case will be, not so much whether the pneumonia is a croupous or broncho-pneumonia, but whether it is due to a diplococcus, strep-

[1] Charcot's *Traité de Médecine*, tome iv. p. 852. [2] *Ibid.*, p. 861.

tococcus, staphylococcus, bacillus diphtheriæ, etc., or to combinations of these organisms. A classification and differentiation based on bacterial causes will be of more value than the anatomical differentiation now in vogue. The last word concerning the etiology of pneumonia has not yet been written.

The existence of the diplococcus in the buccal cavity was known before the relation of the germ to pneumonia was recognized (Sternberg, Pasteur). The frequent occurrence of the coccus in the mouth and pharynx offers a ready explanation, through auto-infection, for the development of pneumonia when the organisms are in sufficient numbers, of the requisite virulence, the lungs unusually vulnerable, or the environment favorable for the growth of the germ. The frequent relapses so common in this affection are more clearly understood when we call to mind the almost uniform presence, for months and years, of the pneumococcus in the bucco-pharyngeal cavity of patients who have had pneumonia.

The resistance of the pneumococcus to desiccation, particularly when in sputum, enables one more clearly to understand the apparent contagiousness of the disease and its repeated appearance in the same house, to which fact reference has already been made. Pneumonia may be regarded as contagious in the same sense in which typhoid fever and pulmonary tuberculosis are contagious—*i. e.* in order that the disease may be communicated from the patient to the well person the germ must be communicated, and this germ, so far as danger of communication goes, resides solely in the sputum of pneumonia and pulmonary tuberculosis and in the stools of typhoid-fever patients. The necessity for proper disposal of the sputa of pneumonics is thus early seen.

The fact that pneumonia is more common in the winter and spring is well known. Why this is so is still unsettled. No age and no sex is spared.

Debilitating or depressing diseases offer favorable conditions for pneumococcic invasion. It is the terminal affection, therefore, in many cases of Bright's disease, alcoholism, malignant growth, typhoid fever, diabetes, etc. Contusion of the chest may be followed by lobar pneumonia. Exposure to cold is the history in many cases, and probably favors the development of pneumonia by producing a *locus minoris resistentiæ* in the lung. The inhalation of gases or of mineral dust may be an exciting cause for the localization of the coccus. Previous attacks, as has been said, confer but a brief immunity and predispose to second attacks.

Treatment.

The treatment of lobar pneumonia may be discussed under the heads of prophylactic and active treatment.

Prophylactic Treatment.—Recognizing that pneumonia is especially prone to attack the weak and debilitated, especial care should be exercised by such people to avoid exposure to cold. There seems to be no question that in a certain proportion of cases, by no means insignificant, exposure to cold is the determining cause of a localization of the pneumonic process in the lung. Patients with Bright's disease, diabetes, malignant growth, primary or secondary anæmia, and, above all, those who have previously had pneumonia, should be extremely cautious as to exposure to cold, and should avoid unnecessary contact with patients ill with pneumonia. The writer has known of more than one instance where a patient in a room with a pneumonic has contracted the disease. It is wrong to bring cases of typhoid, malaria, bronchitis, measles, pertussis, etc. into too close relation with pneumonia. Without doubt, in not a few hospital cases where typhoid has been complicated by pneumonia the secondary infection could be traced to a case of pneumonia in a neighboring bed, cared for, perhaps, by the same nurse.

The danger of communication of the disease from one patient to another can be reduced to a minimum by the proper disposal of the sputa. The pneumococcus in the sputum resists light and drying much longer than in pure cultures. It has been found actively virulent in dried sputum after the lapse of several months.[1] Netter is emphatic in his declaration that the contagiousness of pneumonia resides solely in the sputum containing the coccus. This being the case, the necessity for proper disposal of sputa is clear. As much care should be exercised as in a case of pulmonary tuberculosis. Proper cups should be provided, either of paper, so as to permit of burning, or of metal so that they may contain some germicidal solution and may be cleansed by boiling. Handkerchiefs should preferably be of cheese-cloth, frequently changed and burned. It would be well to have a towel or large napkin tied about the neck of the patient to catch any stray sputum and thus to save the bedding and garments of the patient. This napkin could be frequently changed and boiled. The utensils employed about the patient, as well as the clothing, should be sterilized before being again put to general use. The nurse should exercise unusual care in seeing that the face and hands of the patient, as well as her own hands, are often cleansed. Such directions may seem pedantic. It is probably only man's relative insusceptibility to the pneumococcus that prevents the more frequent endemic outbreak of pneumonia in families and in hospitals where cases of this disease are taken care of in the too often negligent manner as regards sputum-disposal. But we must remember that this extreme care may prevent a nurse, a patient sick of some other disease

[1] Bordoni-Uffreduzzi, *Arch. per le Science med.*, 1891, vol. xv. fasc. 3, p. 341.

in a neighboring bed, or an occupant of the same room or house from contracting, not alone pneumonia, but some other pneumococcal affection. From a carelessly handled case of pneumonia (compare a carelessly handled case of pulmonary tuberculosis) cocci may lodge in the nose or pharynx of some innocent person, to work harm at some later time, perhaps, in the shape of pneumonia, meningitis, arthritis, pleuritis, or any of the varied manifestations of this protean microbe. With proper care a case of pneumonia need be no more a source of danger than a case of pulmonary tuberculosis, typhoid fever, or cholera.

Active Treatment.—The active treatment may be specific, expectant, or symptomatic.

Specific Treatment.—A glance at the mortality statistics of pneumonia, where the death-rate is anywhere from 1 or 2 per cent. to 50 per cent., will convince one that there is no specific treatment that is uniformly successful.[1] A study of the literature on the therapeutics of pneumonia, a perusal of the discussion on the treatment of this disease in the British Medical Association,[2] or of the symposium by American pædiatrists,[3] or by Paris physicians,[4] shows such a lack of uniformity in treatment as to convince one that there is no drug or remedial agent universally employed in pneumonia and accomplishing such definite results as to be called a specific. There is no drug for pneumonia comparable to quinine for malaria, potassium iodide for syphilis, iron for chlorosis, thyroid extract for myxœdema, diphtheria antitoxin for diphtheria. One may, in one's own limited experience, become convinced that the excellent showing made in the series of 20 or 50 or 100 cases is due to the remedial agent employed—that this agent is a specific; but the next few cases or the next epidemic may show one that, after all, it was but the *vis medicatrix naturæ*, favorable environment, etc., and not one's remedy that wrought the cure.

Serum-therapy.—The hope for a specific lies in the direction of serum-therapy. Promise of much has been given, and we are justified, from what has already been accomplished, in looking for an antitoxic serum or antidotal chemical that shall do as much for croupous pneumonia as the Behring antitoxin has done for diphtheria.

No anti-pneumotoxin or healing serum is yet on the market. Nor have results thus far, particularly in the treatment of pneumonia in man, been uniform enough or in large enough numbers to warrant definite statements concerning the serum treatment of pneumonia.

Immunity can be conferred upon animals (rabbits, mice, guinea-pigs) by the injection of filtered cultures, cultures heated for an hour

[1] Wells (*Journal of the American Medical Association*, 1892) in 233,730 cases found a mortality of 18.1 per cent.

[2] *British Medical Journal*, Nov. 9, 1895.

[3] *Archives of Pædiatrics*, April, 1896.

[4] *La Semaine médicale*, 1891, No. 55.

or two to 60° C. (G. and F. Klemperer, 1891), or by the use of the juices from animals dead of pneumococcal septicæmia (Emmerich and Fowitzky, 1891). Various other methods of producing immunity have been successfully tried. Diluted but virulent cultures have been employed (Emmerich). Belfanti (1892) succeeded with a filtrate obtained from pneumonic sputa; Foà and Scabia (1892) used a glycerin extract from the blood of an infected rabbit. Immunity conferred in any of these various ways appeared in from a few days to two weeks, and lasted varying lengths of time. The Klemperers called the substance that is injected in the cultures, the juices, or the extracts, the pneumotoxin. As a result of the protective inoculation an antidotal substance is produced in the body of the animal rendered immune, to which substance they gave the name anti-pneumotoxin. This name and theory have been quite generally accepted since the Klemperers' communication in 1891. This important article, that is so often referred to in recent works on pneumonia, is in the *Berliner klinische Wochenschrift*, 1891, Nos. 34 and 35.

But another important fact announced by the Klemperer brothers and by Emmerich and Fowitzky[1] was that serum or expressed juices from an immune animal when injected into other animals rendered them immune. More than this, the serum from an immune animal had the power to check the progress of infection in an animal inoculated with the pneumococcus. The Klemperers found a prompt reduction of temperature followed the injection of blood-serum from an immune animal into the circulation of an infected animal. This was not a mere antipyretic effect, as a drop in temperature did not occur when similar amounts were injected into healthy animals or into animals infected with organisms other than the pneumococcus.

From experiments on animals they turned to pneumonia in man. Injections of serum from immunized rabbits produced fall of temperature. This was not always permanent, but was prompt and unmistakable. In diseases other than pneumonia, *e. g.* typhoid fever, no effect followed the injections of serum. Others have repeated their experiments with varying results. Mosney's[2] results in animals were less favorable. Foà and Scabia, while successful in the case of animals, were not so fortunate in the case of man. Emmerich criticizes their work because they did not use the serum of "highly immune" animals. Bonome,[3] repeating Klemperers' experiments, could readily induce immunity, but was not so successful in his therapeutic effects. C. Jannson[4] had favorable results in 10 cases, using serum

[1] *München. med. Wochenschrift*, 1891, No. 32.
[2] *Archiv. de Méd. experimentelle*, 1892, No. 2.
[3] *Fortschritte der Medicin*, 1891, No. 18.
[4] *Hygeia*, April, 1892, abstract in *Centralblatt für innere Medicin*, 1892, p. 847.

of immunized rabbits. In 1 case in particular the effect was "marvellous." Shattuck, in an address before the Massachusetts Medical Society in 1893, reported that in 39 cases of pneumonia in man treated by serum 38 had recovered. Hughes and Carter, using serum from convalescents, had rather negative or uncertain results. Lichtheimer[1] used blood-serum and pleural exudate from pneumonics with seeming good results. If the Klemperers' experiments, using cultures heated to 60° C., are found to be uniformly successful, the problem of serum-therapy is much simplified, as the immunizing material is thus quite readily obtained.

It seems that these investigators are on the right track, and that the future treatment of pneumonia is in serum-therapy. To quote Emmerich: "The active principle (healing substance, *Heilstoffe*) in the serum of immune animals will some day be found to have an ideal curative power for man; this is certain and only a question of time." The treatment may not, however, be so simple as at first sight it would seem to be, for in diplococcal pneumonia, as in diphtheria and pulmonary tuberculosis, secondary and mixed infections often play an important rôle, and pneumococcal serum-therapy may have to be combined with that of other organisms in some cases before success is met with.

Treatment by Cold to the Chest.—While it is not claimed by those who advocate the application of ice to the chest that this method is a specific in pneumonia, they do claim that it should be used in every case of the disease, that it reduces mortality to a lower point than does any other method of treatment, and that it is more than a symptomatic treatment. It may therefore be properly discussed under the head of specific therapy.

The application of cold was advocated as far back as Niemeyer's time. Lately there has been a revival of interest in this matter, and enthusiastic writers urge that it should be the treatment for all cases of pneumonia, comparing their results by this treatment with the results of the Brand treatment of typhoid. A reduction in temperature, a lessening of pain, a slowing of the pulse and of respiration, are observed soon after the ice is applied. But it is believed that there is more than this symptomatic improvement. The violence of the inflammatory process is mitigated by contraction of pulmonary capillaries and improvement of their tone, and resolution is favored. This is believed to be the case not alone from subjective symptoms and early crisis, but because physical examination reveals "a striking arrest in the development of the physical signs"[2]—a repression of the inflammatory process in the lung.

[1] *Deutsche med. Wochenschrift*, June 23, 1893. [2] Lees, *Lancet*, Nov. 9, 1889.

Dr. Thomas J. Mays of Philadelphia writes as follows:[1] "How it can dissolve an exudate or an infiltration is not so clear to me. That it accomplishes this I am firmly convinced. For example, there is a pneumonic area which is wholly devoid of vesicular sounds, and has a flat percussion note and bronchial breathing, indicating beyond doubt that the process has passed beyond the stage of engorgement and into that of exudation or of infiltration; yet the application of ice to this spot will in a remarkably short time develop a new group of physical signs, such as crepitation, reappearance of the vesicular murmur, diminution of flatness. This has been observed by myself over and over again."

In this method of treatment cold is applied by means of ice contained in bags which are wrapped in towels. The affected area is covered with these bags, even though two or more are required. If the inflammation extend to other portions of the lung, it is followed up with the ice-bag.

No bad results are reported from this method of treatment. The statistics of Mays[2]—195 cases—show 7 deaths, a mortality of 3.58 per cent. The number of cases is far too small to permit of generalization. Yet it is but fair to record that in the experience of Drs. Mays, Lees, and some others the ice-bag treatment of pneumonia is safe, lessens unpleasant symptoms, hastens resolution, and gives a low mortality rate.

Digitalis.—Petresco[3] (Bucharest) has repeatedly asserted that the most favorable results in pneumonia were obtained by the use of large doses of digitalis. When we remember the cautions ordinarily urged against the use of too much digitalis, we are astonished to read that Petresco claims that unless 75 to 150 grains of digitalis-leaves are used in twenty-four hours the beneficial effects will not be observed. He makes an infusion of 4 parts of digitalis leaves to 200 of water, and adds 40 parts of syrup of orange-peel. Of this infusion he gives a teaspoonful every half-hour. Petresco has seen no evil results from these enormous doses, even though they are continued for four days. To prove that the leaves he first employed were not inert, he has obtained and used samples from various pharmacists, and always with the same good results and with no toxic effects.

The benefit is seen in a lowering of the temperature, a slowing of the pulse even to thirty or forty, and in an early crisis. Petresco's explanation of the good results of the digitalis treatment is that it stimulates the vagus, improving cardiac, pulmonary, and bronchial

[1] *Medical News*, October 13, 1894.

[2] *Trans. Philadelphia County Medical Society*, 1895, xvi.

[3] Petresco has written many articles on this subject. As containing the substance of his writing may be consulted: *Therap. Monatshefte*, February, 1891; *Revue de Méd.*, 1894; and the *Proceedings of the XI. International Congress in Rome.*

activity, and seriously modifying the inflammatory process. Since 1883 he has treated 1192 cases, with a mortality of 1.2 to 2.6 per cent. The crisis commonly occurred on the third day, the temperature often falling considerably below normal, and the pulse frequently dropping to 36.

In this connection one fact must not be forgotten, that Petresco's cases are selected cases. His patients are soldiers between the ages of twenty and twenty-five. He therefore has excluded for him, by the rigid examination required before entering the army, the two dangerous extremes of life, all previously existing chronic complications, such as Bright's disease, heart disease, diabetes; and his patients are too young to show the later effects of alcoholism and syphilis in vessels, heart, brain, cord, liver, etc. With the favorable hospital surroundings and with these selected cases the mortality ought to be unusually low. Yet his statistics attract attention because of the early crisis and the tolerance of the enormous doses of digitalis, as well as for their favorable ultimate results.

Stimulated by Petresco's success, others have tried the digitalis treatment. Among these may be mentioned Fikl,[1] 1 death in 61 cases; Höpfel,[2] 1 death (a case of mitral stenosis) in 15 cases; Hecker,[3] 27 cases, with no death. Lépine[4] had good results in 40 cases, using digitalin. Danforth[5] reports 3 successful cases by the use of a normal liquid in which one drop represents one grain of the leaves.

Naegeli-Akerblom[6] had success with this treatment when he excludes cases that were hopeless because of late treatment or complicating disease. Recalling the fact that in pneumonia that terminates favorably there is commonly a pre-critical polynuclear leucocytosis (Tchistowitsch, Biegansky, von Jaksch, Kikodse, and others) Naegeli-Akerblom undertook experiments upon healthy rabbits and upon men, and found that large doses of digitalis produce a marked leucocytosis. He sees a connection between this hyperleucocytosis and the favorable course pursued by pneumonia under the digitalis treatment. The use of cold water in connection with digitalis is advised, as still further tending to induce leucocytosis.

Unfavorable reports are, however, not lacking. Leo Havas[7] found in 3 cases such evidence of toxic effects—nausea, vomiting, vertigo, mydriasis, muscæ, irregular pulse—that he felt forced to give up further trial. Löwenthal[8] admits that doses of forty to sixty grains

[1] *Wiener med. Wochenschrift*, 1891, Nos. 24 and 25.
[2] *Therap. Monatshefte*, April, 1892.
[3] *Militarärztl. Zeitung*, 1893, No. 1.
[4] Lépine (Lyon), *Semaine méd.*, January 20, 1892.
[5] Wilson's *Text-book of Applied Therapeutics*, article "Pneumonia."
[6] *Centralblatt für innere Medicin*, 1895, No. 32.
[7] *Pester Med.-chir. Presse*, 1894, No. 26.
[8] *Centralblatt für die gesammte Therapie*, November, 1891.

are not necessarily toxic, and may even improve the action of the heart. He failed, however, in 12 cases to be convinced of any specific effect of the remedy in pneumonia. Rechtshamer[1] found the large dose of benefit in some cases of pneumonia in the aged. In the young he believes the drug is often unnecessary.

Fixation Abscess.—Fouchier has devised a method that is, to say the least, novel. He injects under the skin from 15 to 30 minims of turpentine, producing in this way an antiseptic abscess. He believes that in this manner a suppurative process is "drawn away" from the lungs or is fixed at this new point. Whatever virtue there may be in this method of treatment—and it has received the sanction of two or three French clinicians (Lépine, Dieulafoy, Gingeot)—is probably to be explained, as Chantemesse has suggested, on the ground of the leucocytosis produced. This method has been condemned by the profession at large rather by being ignored and passed over in silence than by argument against it or clinical experience opposed to it. Ferrara, however, vigorously declares its uselessness.

Injection of Salt Solution.—Bollinger,[2] after studying the subject of pneumonia, has reached the conclusion that the cause of death is primarily through oligæmia, the blood being robbed by the process of exudation in the lung. Cardiac weakness is but secondary, being the result of poorly nourished myocardium. He suggests as a possible treatment, founded upon this hypothesis, the injection of normal salt solution. In a few cases successful results have been reported by this method of treatment, and normal salt solution combined with bicarbonate of soda has been injected, on the theory that it prevented coagulation of blood in the cavities of the heart.

Several other methods of treatment that are regarded by their advocates as closely approaching specifics might be mentioned. Among these is the treatment with chloride of calcium and the treatment by pilocarpine.

Symptomatic and Expectant Treatment.—The foregoing methods of treatment have been described, not because the writer believes that one or all of them are specific modes of treatment, but because in an article of this kind it is but justice that the various methods should be outlined. When one reads carefully of different methods of treatment of pneumonia, and sees the various claims that are made for different treatments almost diametrically opposed, and, above all, when one sees in hospital and private practice one line of treatment giving practically the same results as another line; when one sees on one side of a ward patients treated by so-called homœopathic methods, and on the other patients treated according to the best practice of the regular school, and sees these patients getting

[1] Abstract in *V. u. H. Jahresbericht*, 1895. [2] *Münch. med. Woch.*, 1895, No. 32.

well or dying in the same way on the one side as on the other, then one realizes that there is, as yet, no specific for the treatment of pneumonia. In fact, all physicians with large hospital practice have seen many a case of pneumonia get well without a single dose of medicine. It is, moreover, questionable whether there is any medicine that can modify or abort a case of pneumonia. More than this, many a patient has lost his life through improper medication or through over-medication rather than through natural causes. If we are to believe Dietl, he had 939 cases of pneumonia with practically no treatment, and a death-rate but little over 8 per cent. It is certainly a wrong practice to prescribe in a routine manner ammonium carbonate, aconite, veratrum viride, chloride of calcium, whiskey, morphine, bleeding, merely because we have made a diagnosis of pneumonia. This is not a new statement, and yet it bears repetition, as its truth is frequently forgotten in practice. In the absence of any specific treatment the therapy must be expectant or symptomatic. To repeat: Many a patient needs no prescription at all, except perhaps for politic reasons or to satisfy friends.

While, therefore, admitting that there is no abortive treatment for pneumonia, no specific treatment for the disease, and while admitting that the proper treatment, according to our best knowledge to-day, is the expectant and symptomatic treatment, it must not be understood that nothing can be done for a case of pneumonia, and that the outcome is to depend entirely upon the *vis medicatrix naturæ*. We can, as Jürgensen so forcibly pointed out, try to support the powers of life until nature shall effect a cure; we can see to it that our patient is put in the best possible condition to withstand the storm; we can see to it that we avoid all dangers that we know threaten in this disease. Many points that merit more extended discussion will be briefly alluded to, as they have been fully discussed in the excellent article by Graham in the earlier volumes of this work.

The Room.—The room in which the patient lies should be light, airy, and well ventilated. If there is any one disease in which an abundance of pure air is needed, it is pneumonia. There is a lesson in the story that is told of one of our Chicago physicians who, entering a tenement-house to see a case of pneumonia in consultation, before proceeding to the examination of the patient or to a formal consultation broke out a few panes of glass with his umbrella.

Rest.—In this disease, as in diphtheria, there is the greatest necessity for impressing upon patient and upon nurse that rest in bed is essential. The great danger of cardiac failure is too well known to be referred to at length. This danger, it must be remembered, does not leave with the crisis. Not a few lives have been lost because of a little carelessness on the part of friends or nurse

after the crisis has been passed. I have known a patient to fall back dead when reaching over to get a cup of coffee from the table placed by the side of his bed. In one of my ward cases a patient who came in late at night, apparently not very ill, and who was not examined, was allowed to go to the closet, where he fell dead. The autopsy showed a lobar pneumonia of the middle lobe.

Diet.—While care should be exercised as to the diet in pneumonia, there is not so great a necessity of being particular as in cases of typhoid fever. A patient with pneumonia can be allowed to partake freely of milk, of broths—in fact, of any liquid food. There is no objection to meats that are easily digested being taken. So, too, bread, toast, eggs, even some starchy foods, may be allowed in moderate quantities. There is danger, however, in this disease of over-feeding the patient, just as there is danger of over-feeding in typhoid. When the stomach is rebellious, when there is a tendency to diarrhœa and fermentation, the diet should be carefully watched, and it may be well for several hours, or even for an entire day, to allow but little, if any, food. A patient with pneumonia should be allowed to take water freely. It satisfies thirst, tends to keep the bowels, the kidneys, and the skin in free action. There is no reason why a pneumonic should not be allowed plenty of water.

Local Applications.—The question of poulticing the chest of a pneumonic always comes up. Among the laity it is still regarded as the proper thing to do, but there is probably more danger from poulticing the chest than from omitting to do this, unless a large poultice, carefully applied, frequently changed, and patiently watched, so that it does not cool and does not slip, can be employed. This is seldom, in practice, feasible. A much simpler, neater, and, we believe, as efficient, application is that of the cotton jacket. Just how a cotton jacket acts is perhaps not clear, but certainly many intelligent patients claim that they feel more comfortable after the cotton jacket has been on for a few hours than they did before.

Disposal of Sputa.—It will not be amiss to repeat the statements already made as to the necessity of prophylaxis. The nurse should be instructed as to the proper disposal of the sputum. This lessens the liability of the contraction of the disease by nurse or by other attendants. Sputum-cups, and handkerchiefs that can be burned, should be employed.

Fever.—High temperature in pneumonia, which is a disease ordinarily running a short course, is not of necessity bad; in fact, some, as Cantani, regard a high temperature as beneficial. Statistics of pneumonia seem to show that those cases do best where the temperature ranges between 103 and 105°. Patients with temperature above 105° usually do poorly; patients with temperature between 100°

and 103° also do poorly. Where the temperature, however, remains above 104°, particularly if, at the same time, there is nervous disturbance in the shape of delirium and restlessness, with bounding pulse and hot, dry skin, the reduction of the temperature is of advantage. Several different ways of reducing temperature in pneumonia are advocated. By many (Jürgensen, Ziemssen, Bartels, and others) the cold bath is advocated. Others rely upon sponging or upon the cold pack; still others apply ice to the chest for the reduction of temperature; and this method, as has been stated, is believed by many to be not alone efficacious in the reduction of temperature, but aids in jugulating the disease.

Two classes of remedies have been at various times advocated—the antipyretics of the coal-tar series and aconite and veratrum viride. The use of the latter drugs should be restricted to the early stage of the disease, and will be discussed under the head of the Heart. Quinine as an antipyretic has been almost entirely discarded. A great deal has been said against the use of the coal-tar antipyretics in the reduction of the temperature in the acute infectious diseases, including pneumonia. There can be no question that harm can come from the giving of these remedies. Cyanosis and collapse may occur. But when it is found in a pneumonia that sponging fails to reduce temperature, when the pulse is full and strong, the skin dry and hot, the patient restless, a moderate dose of acetanilid, of phenacetin, or of antipyrin is in order. A great many practitioners are in the habit of giving far too large doses, and for this reason toxic effects have been noted. Two grains of acetanilid, three grains of phenacetin, and four or five grains of antipyrin should be the ordinary dose for a strong, vigorous adult. When one sees ten and fifteen grains of acetanilid given at a dose, and ten grains of phenacetin as the ordinary dose, it seems no wonder that there is a prejudice among the profession against the use of these remedies. By the giving of two grains of acetanilid a temperature of 105° can frequently be reduced to 101°. At the same time, the pulse will drop ten or fifteen beats and lose its angry quality; the skin becomes moist, the delirium disappears, the patient drops off into a quiet, refreshing sleep. Symptomatically, at least, the remedy has done good. In case the temperature an hour and a half after the administration of the antipyretic has not subsided, the dose can be repeated. Not infrequently a small dose of codeine and a small dose of caffeine citrate can be combined with the acetanilid, which is, perhaps, the best of the remedies mentioned.

Pain.—One of the most troublesome symptoms to combat in cases of pneumonia is the pain. Many local measures have been recommended for its relief. Probably the very best is the local abstraction of a little blood by means of a few leeches. Ice to the chest will also

relieve pain; so will hot applications if kept continuously applied. A counter-irritant or blister is frequently employed by many physicians. In some cases strapping of the chest, as is done in cases of fracture of the rib or of simple pleurisy, can be employed. The very best method, however, for the relief of pain is the use of opium in some form. Codeine in one-quarter to one-half grain doses will sometimes be efficient. Severe pain demands the use of stronger preparations of opium, either the use of Dover's powder or, better still, the use of morphia hypodermically. It has been frequently said of late, as regards bloodletting in pneumonia, that the pendulum has swung too far in one direction. The same may be said, I believe, as to the use of opium. There is certainly a too strong prejudice in the minds of many practitioners against the use of opium because of its interference with the function of respiration. There are many cases of pneumonia in which opium in some form should be given, and should be given heroically. Where a patient is suffering from severe pain which interferes with the act of respiration, and thus with proper oxygenation, which prevents sleep and which makes him more nervous and restless than before, it is idle to trifle with simpler and less efficient remedies. Morphine should be given hypodermically in sufficient doses to relieve the pain. The patient will sleep, he will lose his restlessness, the pulse will become stronger, the breathing will be better, and in every respect his condition will have been improved.

Cough.—For the cough of pneumonia it is perfectly useless, or worse than useless, to give the ordinary nauseating expectorants. The various syrups, the carbonate of ammonium, the chloride of ammonium, tartar emetic, and all that class of remedies are worthless. The best remedy to employ when cough is so persistent as to keep the patient awake and to keep him excessively nervous is codeine in $\frac{1}{8}$ to $\frac{1}{4}$ grain doses, or morphine. Codeine is preferable, because it can so frequently be repeated without danger, and because it is less liable to upset the stomach and bowels. Bartholow recommends for cough, as well as for the heart and dyspnœa, the inhalation of iodide of ethyl, twenty to thirty drops upon a handkerchief.

Dyspnœa and Cyanosis.—For the dyspnœa and cyanosis in the early stage bleeding is probably the very best treatment. In the latter stage, where there is right-heart dilatation with consequent cyanosis, bleeding is recommended, but very few cases are recorded where much good has come from bleeding at this late stage. The good effect of the cathartic is sometimes seen in these cases, particularly where the bowels have been constipated for two or three days and where there is much tympany. The cyanosis and dyspnœa frequently depend upon cardiac weakness, when the treatment should be that outlined in the next paragraph. The use of oxygen has been

warmly recommended, and in these recommendations the writer fully concurs. Where the cylinders of oxygen can be obtained in our larger cities, and among patients who can afford this luxury, it can be given every few minutes or even continuously, pure or diluted. The effect in some cases is quite marked. There is an improvement in the pulse and in the color. The patient may drop off into a quiet, refreshing sleep.

Heart, Pulse, Stimulation.—Whatever theories one may hold regarding the pathology of pneumonia or the cause of death in this disease, all are agreed that there is great danger from cardiac weakness. Jürgensen's strong statement is that the object of treatment should be to sustain the heart until nature effects the cure. There is great necessity for careful watching throughout the entire course of the disease. A pulse that remains steady and strong as the disease progresses is one upon which a favorable prognosis can be based, though many of the other symptoms, as temperature, may seem to be unfavorable.

Early in the disease bloodletting will cause a slowing of the pulse and a loss of the angry quality, showing that the heart has been relieved of the excessive work placed upon it. Those who advocate venesection advocate it as an early, and not as a late, measure. There are many who believe that bloodletting is not necessary when we have at our command the two therapeutic lancets, aconite and veratrum viride. A patient can be just as well bled into his own veins as into a basin, is the statement of these physicians. The use of these remedies—aconite and veratrum viride—is, however, not without danger. Blood-pressure is relieved largely through a weakening of the cardiac beat, and this would seem to be contraindicated in pneumonia. Where aconite or veratrum viride are given in moderate doses and the effects carefully and intelligently watched, they may do good, but in the hands of patients and of many practitioners they are certainly capable of doing much harm. I have known ten drops of veratrum viride to be given every two hours for three days; at the end of this time the pulse was 90, gaseous and weak; the heart sounds were scarcely audible. The patient was cyanotic, had been vomiting at intervals for two days. Notwithstanding the stopping of the veratrum viride and vigorous stimulation, he died a few hours later. While the writer has not, perhaps, used veratrum viride as faithfully and intelligently as he should, he has never seen any benefit come from its employment.

One of the very best cardiac stimulants is strychnia. This can be begun whenever the heart is found to be growing a little more rapid and a little more weak day by day. It is best to give the strychnia in small doses early, and in this way to fortify the heart,

than to give the remedy late and when cardiac weakness has become marked. One-sixtieth of a grain of strychnia can be given in pill form or in solution once in six hours. This is a dose that can readily be increased by increasing its frequency, as occasion demands, until one-sixtieth of a grain is given every two hours or until one-thirtieth of a grain is given every three hours. Where there is irritability of the stomach or where the absorption is questionable the drug should be given hypodermically.

Digitalis is a remedy that certainly has a place in stimulating the heart in pneumonia, even though we may not employ the enormous dose advocated by Petresco. Given on the fourth or fifth day, when there are symptoms of cardiac failure, it will be found in many cases of great service. Caffeine is a remedy that is advocated by some. Where collapse occurs, particularly at the time of crisis, hypodermic stimulation by the aromatic spirits of ammonia, ether, and strychnia may sometimes carry a patient through this most dangerous period.

There is among the profession still some question as to the value of whiskey (or, more strictly speaking, alcohol) in the treatment of pneumonia. Probably all are agreed that in alcoholic pneumonias the sudden withdrawal of whiskey, the poison to which the patient has been accustomed, is liable to be followed by dangerous cardiac weakness. Under these circumstances whiskey should certainly be given. It is the testimony of most physicians that in cases of pneumonia where there is great toxæmia, where the patient is in a typhoid condition, delirious, or stupid, with parched tongue, rapid pulse, twitching tendons and involuntary discharges, alcohol in some form should be given. The good effects are seen when the patient becomes more quiet, the tongue becomes moist, the pulse improves in quality, the muscular twitchings diminish. An increase in delirium generally means that the alcohol is poorly borne or is in too large dose. When whiskey is given and the good effects are manifest, it should be given in full doses. Half an ounce every four hours, every three hours, or every two hours should be given day and night. Wilson Fox gave in one night twenty ounces to a pneumonic. Particularly as the time for crisis approaches should the heart be carefully watched, and the nurse should have instructions that if, as the temperature drops, the pulse becomes weak and rapid instead of becoming slow and strong, she should give hypodermically strychnia and apply heat externally and should give an additional dose of alcohol internally. As regards the use of alcohol, it may be said here that most pneumonics will go through the course of the disease without alcohol, but when it is indicated it should be used, and used fearlessly.

Delirium and Insomnia.—For the delirium of pneumonia an ice-cap is sometimes beneficial. In many cases, too, as the temperature is lowered by some of the methods previously described the delirium disappears. When other means fail a hypodermic of morphia will quiet the patient and permit of sleep. Balfour gives to almost all of his pneumonics digitalis and chloral, finding in this combination a quieting remedy and at the same time one that stimulates the heart. Chloral is frequently well borne by these patients, and, particularly if fortified by digitalis or strychnia, need not be feared. It is sometimes necessary to give it *per rectum*. The other hypnotics that may be used to quiet delirium and to induce sleep are sulphonal and trional. Both these remedies are sometimes quite slow in their action. The sulphonal can be dissolved in hot water or given in a cup of hot tea. The trional is best given dissolved in water by the addition of a little alcohol. The action in this way is much more rapid than if given in capsule or in powder. The best dose of trional is about ten grains.

The Bowels and Stomach.—But little need be said as regards the symptomatic treatment of the stomach and the bowels. If we remember the danger of overdosing patients, if we remember the danger of overfeeding patients, we shall not make the mistake of still further irritating an already irritable stomach by giving too much medicine or too much food. Diarrhœa, at times, may be so pronounced as to need some simple astringent. Tympany, too, may be present in cases of pneumonia and may demand the ordinary treatment, such as the induction of free catharsis, the giving of enemata containing turpentine, or the passage of the rectal tube. Abdominal pain is not of necessity an indication of involvement of the peritoneum, but is more commonly due to involvement of the diaphragm. This should be treated by the ordinary methods of treatment of pain as indicated before. Ten or fifteen grains of calomel at a time when crisis seems to be impending sometimes seems to favor its early occurrence.

The Kidneys.—Even in cases where there is involvement of the kidneys in acute inflammation little in the shape of medication is demanded save a free allowance of water. Where the kidneys, however, are found to be acutely inflamed, as occurs in a certain percentage of pneumonias, the use of remedies that would irritate the kidneys should be carefully avoided.

Resolution.—The treatment of the stage of resolution needs but a few words. Ordinarily, tonics, good diet, and, as the patient gains in strength, fresh air and exercise, are all that is required. Pilocarpine has been recommended at this stage. One of the remedies that seems to aid absorption is iodine, either in the shape of the iodides or applied locally. It should always be remembered that symptoms of delayed

resolution may sometimes be simulated by pleural exudates. If these are present, the proper treatment for an exudate should be instituted, rather than the treatment for a delayed resolution.

BRONCHO-PNEUMONIA.

Broncho-pneumonia is generally regarded as a disease distinct from croupous pneumonia. It is characterized by a bronchitis to which the pneumonitis is commonly spoken of as secondary, by peribronchial inflammatory nodules or large masses that are rarely lobar in their extent, and by secondary atelectasis. As compared with the croupous form, there is a comparative lack of fibrin in the exudate, together with other microscopic differences, a different clinical course, different etiology, and different bacteriological findings.

Broncho-pneumonia is a microbic affection. Various organisms have been found in different cases, at times in pure cultures, but frequently associated. The ones commonly found are the pneumococcus of Fränkel, the streptococcus pyogenes, the bacillus of Friedländer, and the staphylococcus pyogenes. The bacillus of diphtheria is often found in cases complicating pharyngeal or laryngeal diphtheria, and has been found as well where no diphtheritic exudate was present in the upper respiratory tract. These organisms are among the commonest pathogenic organisms found in the nose, throat, and buccal cavities of healthy individuals (Netter, Pasteur, Sternberg, Thost, and others). This suggests strongly the probable source of infection. Carried by air, by inhaled particles of dust, saliva, or mucus into the bronchi and lungs, these bacteria will excite inflammation if they themselves possess the requisite degree of virulence, or if the soil be favorable. Further, any condition—*e. g.* the suppression of the act of coughing—that favors their retention in the lower air-passages will favor their growth. When, therefore, the nose, pharynx, and buccal cavity are particularly foul and unclean, when the bronchial mucous membrane is in such condition as to furnish a fertile soil, and when local or general causes favor the lodgement and retention of bacteria within the air-passages, we should expect the development of bronchitis, bronchiolitis, and broncho-pneumonia.

Broncho-pneumonia in Acute Infectious Diseases, in Infants and in the Aged.—Clinical facts bear out these observations. Broncho-pneumonia is most common when the bronchial tubes are already inflamed and in a favorable condition for the reception of the above-mentioned germs. In children whooping cough and measles are not infrequently complicated by broncho-pneumonia, causing a large per-

centage of the deaths from these two diseases. Here the primary disease is to be looked upon as the predisposing cause, and the pathogenic germ—the pneumococcus, the staphylococcus, etc.—as the exciting cause. Scarlet fever, diphtheria, typhoid fever, small-pox, erysipelas, may in like manner be complicated by this affection. The inability of a child to cough and to rid the tubes of mucus and organisms is the reason the young child or the infant is more liable to be affected than the older, stronger child, who by coughing gets rid of the dangerous material. In typhoid fever, when the nerves are dulled and blunted, the patient gives no heed, though mucus be present in the bronchioles and bronchi. The patient lying often upon his back, the secretions accumulate in the posterior part of the chest. The inspired air, passing through a foul mouth, nose and pharynx, is polluted with numerous organisms that enter the bronchi and vesicles. The conditions are therefore ripe for a broncho-pneumonia—a hypostatic pneumonia. In the aged, too, particularly when afflicted with some debilitating disease or confined to bed, broncho-pneumonia is of not uncommon occurrence. "In certain epidemics due to the pneumococcus, where lobar pneumonia and broncho-pneumonia coexist, it has been noted that the first disease attacks the robust, vigorous, adult subjects, the latter the infants and the debilitated."[1] Children, the subjects of rickets or with deformed chests; weak persons, the subjects of an acute or chronic bronchitis, are especially liable to be attacked with this affection.

Aspiration Pneumonia.—According to the view just advanced, every broncho-pneumonia is practically an inhalation or aspiration pneumonia—*i. e.* due to the inhalation of pathogenic germs. But a separate class is commonly made of the so-called "deglutition pneumonias" that includes those cases where some large foreign material, as a piece of food, vomitus, a plug of dried mucus, etc., has been inhaled, lodged in the bronchioles, and has become the focus of peribronchial inflammation, leading oftentimes to suppuration. Any local or general condition causing the patient to be unconscious of the presence of the foreign body, or unable to extrude it by coughing, will tend to produce a pneumonia of this kind.

Becker[2] has divided these cases into three groups:

(*a*) Cases in which there is a condition of marked apathy, somnolence, or unconsciousness from whatever cause. It may be uræmic, diabetic, due to cerebral concussion or compression, as in the case of tumor, abscess, hæmorrhage, or fracture; it may be the narcosis from an anæsthetic. If under any of these circumstances vomiting occurs, masses of vomitus may remain in the pharynx and with the next

[1] Netter, *Charcot's Traité de Médecine*, vol. iv. p. 934.

[2] "Aspirations-pneumonie," *Inaug. Thesis*, Göttingen, 1887.

inspiration be carried into the respiratory tract, there to act as irritants, and, through the bacteria carried with them and following them, to be the excitants of lobar pneumonia. Many deaths attributed to an accidental pneumonia following an operation can be traced to the inhalation of vomited material during the anæsthesia.

(*b*) Cases occurring in consequence of paralysis of the recurrent nerve. Through paralysis of the adductors of the larynx the entrance of food-particles is favored and the anæsthesia of the trachea and larynx favors their retention by preventing the expulsive cough. The experimental vagus-pneumonia comes under this head.

(*c*) Cases in which the foreign material does not gain entrance through the pharynx and larynx, but through some new opening. A common cause here is the perforation of a carcinoma of the œsophagus; less commonly the perforation into a bronchus of an empyema or hepatic abscess. Suppuration or gangrene frequently occurs in these cases.

Tubercular Broncho-pneumonia.—This is a form not always readily recognized. It should be suspected when evidence of lobular consolidation is present in patients known to be tuberculous and when —*e. g.* following pertussis—the disease hangs on week after week with steady loss of strength of the patient. In other cases an apparently typical lobar pneumonia fails to resolve, and later the formation of cavities or the presence of tubercle bacilli reveals the nature of the disease. Most of these cases are tubercular from the beginning. In some instances tubercular infection may be a secondary process. Osler has laid particular stress upon the existence of a tubercular form of broncho-pneumonia and the importance of recognizing it as influencing materially both prognosis and treatment.

Treatment.

Prophylactic Treatment.—Much can be done to avoid a broncho-pneumonia. A child that is suffering from bronchitis can be kept indoors on stormy days. The feet can be so protected that they do not become wet; extra wraps can be put on when the child goes out into the cold. The child should be watched carefully at night to see that it does not kick the clothes off, and by preference flannel night-clothes should be worn. This extra care should be exercised, particularly during and after convalescence from measles and whooping cough.

In typhoid fever and in other diseases in which the patients are in a typhoid state careful attention to the mouth may avoid a complicating broncho-pneumonia. If the mouth be carefully cleansed with antiseptic solutions, so that the inspired air goes through a cavity that is contaminated as little as possible with pathogenic

organisms, it diminishes the danger of this complication. Again, frequent change of position in typhoids may serve to avoid a hypostatic congestion with consequent pneumonia. One of the benefits of the Brand method of treatment by cold baths is that it induces patients several times a day to change their positions and to take deep inspirations, often followed by coughing, and in this way to rid the bronchial tubes of mucus and dilate the collapsed air-vesicles.

In diphtheria, and particularly after tracheotomy and intubation, it is said that elevating the foot of the bed prevents, by gravity, fluids from entering the lungs, thus lessening the danger of lobular pneumonia. Seymour of Troy, who has advocated this method, believes that his results after intubation have been better since adopting this treatment.

Active Treatment.—The room in which the patient is kept should be bright and airy, and, where possible, at least one thousand cubic feet of air should be allowed to each occupant. The temperature of the room should be between 68° and 70° F.; some say even a higher temperature than this is preferable. It is generally regarded as good practice to have the air of the room moist. This result is obtained by hanging up sheets wrung out of water or by keeping a kettle of water constantly boiling. Many recommend also the slow evaporation of creasote, of turpentine, or pine-needle oil, believing that the vapors are of benefit in these bronchial affections. Others object to this procedure, believing that the practice of filling the air of the room with steam and the vapors of antiseptics is in itself depressing.

Local Applications to the Chest.—The time-honored poultice has been almost discarded by the majority of practitioners, at least in our large cities. Where the poultice can be neatly applied over the entire affected area, where it can be changed frequently enough to be kept hot, there can be little doubt that it makes the patient more comfortable, to say the least. But it is rare that we can have the combination of suitable patient and suitable nurse, so that we feel justified in advising the use of the poultice. The cotton jacket, by keeping in the heat of the body and the sweat, really answers every purpose, securing heat and moisture. A less cumbersome jacket can be made by covering the under-shirt on the outside with oiled silk. The shirt should be previously opened down the front, so that it can be slipped on and off easily. Local bloodletting by leeches is now advised by but very few. Mild counter-irritation, as by camphorated oil or oil and turpentine, is in order. Some quite regularly apply stronger counter-irritation. Thus Holt advises the use of mustard and flour as a paste or poultice, left on long enough to redden the skin and repeated several times daily.

Diet.—Water should be allowed freely for its diuretic and diaphoretic effect. According to the age of the child, it should be nursed from the breast, or be given milk previously peptonized, ordinary cow's milk, or liquid diet. Older patients may be given a light diet, the same as in cases of lobar pneumonia. It is wrong to force food into a child or older patient when the stomach is irritable and is occasionally rejecting food by vomiting. This is particularly the case in broncho-pneumonia, for much depends upon the integrity of the stomach and of the bowels; for broncho-pneumonia, unlike lobar pneumonia, frequently lasts for many days or several weeks, and to maintain the strength of the patient the stomach and bowels must be in good working order both for the reception of food and of medicine.

The Bowels.—An initial dose of calomel or castor oil should be given. This can be repeated at any time during the course of the disease. A distended colon is not only a source of discomfort to the patient, but, in children particularly, may be the cause of cyanosis, impaired respiration and nervous excitement. Even convulsions have been attributed to this condition. Cathartics should therefore be used often enough to keep the bowels open, or enemata can be given to rid the bowel of the accumulation of gas. It is to be remembered, too, that in pneumonia of children the mucus that is expectorated is swallowed. This may be rejected by vomiting or it may enter the intestine. A cathartic will sometimes bring away a large amount of this mucus; that must not be looked upon as necessarily indicating a catarrhal condition of the bowel.

Baths, Sponging, Antipyretics.—No definite rules as to the use of antipyretic measures in broncho-pneumonia can be given. The thermometer should not be the only guide for the use of these measures. Each child in this particular is a law unto itself. A temperature of 105° in one child may cause much less disturbance and be less a source of danger than a temperature of 103° in another. We must be guided in the use of antipyretics as much by the existence of delirium, restlessness, tendency to convulsion, character of the pulse and dryness of the skin as by the actual temperature. The best method of reducing temperature in children is ordinarily by the sponge-bath or by the pack. Where the temperature is high and stubborn and there are marked constitutional disturbances, a cool bath may be given with great benefit. There is considerable prejudice among the profession against the use of the coal-tar products for the reduction of temperature; but in children they are particularly well borne. Where it is found that the use of water is disagreeable, resisted by the child, or is without results in reducing temperature, antipyrin, phenacetin, or acetanilid can be given. The effect of this in proper doses is usually marked and beneficial. The temperature falls,

the pulse becomes slower and quieter, the restlessness ceases, the child drops to sleep, the skin becomes moist. In children antipyrin is often the best preparation to give, because of its solubility. It may be combined with bromide:

℞. Antipyrin., gr. xxiv (1.6);
Sodii bromidi, gr. xlv (2.65);
Syrupi lactucarii, ℥ij (60.0).—M.
Sig. Take one-half teaspoonful for restlessness.

A child of four to six years can take about two-thirds of a grain of acetanilid.

Aconite by some is regularly employed, particularly in the early stages of these pneumonias. Here it is perhaps of some benefit, but it is a somewhat dangerous drug to put into the hands of parents, and its beneficial effects are questionable.

Cough, Expectorants, etc.—Expectorants in general are harmful. Carbonate of ammonium, if given in doses large enough to have an expectorant effect or a stimulant effect upon the heart, is not well borne. Squills, ipecac, senega, are useless. Yet at times large enough doses of ipecac can be given to induce vomiting, and in this way rid the bronchial tubes of accumulated mucus. Chloride of ammonium is frequently given as a routine treatment, but the benefits from it are questionable. Where the cough is excessive, evidently painful, and is keeping the patient awake, codeine tablets or the phosphate of codeine in solution can be prescribed. Tully's powder is a favorite method of giving opium with some, as is paregoric with others. It is perhaps needless to give the caution that all opiates to children should be given in proportionately smaller doses than to adults.

For the relief of cough several vapors have been advocated. Reference has already been made to the use of creasote in the room, and of turpentine or benzoin. The lamp that is known as the vapo-cresolene lamp is of great benefit in whooping cough, and will be found at times to relieve the coughing spells, particularly those that occur at night, of bronchitis and broncho-pneumonia.

Swift,[1] at St. Mary's Free Hospital for Children in New York, uses chloride of calcium, 2 to 5 grains every two or three hours. He believes that in pneumonia, particularly of the lobar type, it may in a measure jugulate an attack, and is sure that it aids expectoration. It has at least, as he says, the virtue of being harmless.

Stimulants.—It is not wise in broncho-pneumonia, any more than in lobar pneumonia, to give stimulants until there is special indication for the same. Alcohol is used by almost every practitioner in

[1] *Archives of Pædiatrics*, April, 1896.

severe cases of broncho-pneumonia. This can be given in the form of brandy or whiskey diluted with water. In the case of small children, who object to the taste and smell of the whiskey or brandy, Cologne spirits or deodorized alcohol may be substituted. The dose must be governed by the age of the child, the severity of the case, and the effects noted after the administration of the remedy. Strychnia is one of the best heart and respiratory stimulants. It can be given to a child in a little camphor-water, when the bitter taste will scarcely be noticeable. A child of one year can take gr. $\frac{1}{300}$ every six to every two or three hours. Digitalis should be prescribed only as indicated by the condition of the heart. For sudden cardiac failure or collapse nitro-glycerin is probably the best remedy. Aromatic spirits of ammonia may also be given. The objection to digitalis, that it contracts peripheral blood-vessels, may be overcome, in some instances at least, by combining digitalis with nitro-glycerin. The former drug strengthens the heart's action, the latter dilates peripheral vessels, and in this way a congestion of the pulmonary vessels may be in a measure relieved. The infusion or tincture of digitalis can be combined with the spirits of glonoïn—*i. e.* a 1 per cent. solution of nitro-glycerin.

When cyanosis becomes more pronounced and the strength of the child fails, when respiration is performed with great difficulty and the child is seen to be rapidly losing ground, stimulating measures should be instituted. A hot bath of a temperature of 103–105° F. can be employed, or the child can be placed alternately in hot and cold water. In this way the respirations are sometimes stimulated. Under these circumstances, too, the use of oxygen may be of benefit. Belladonna has seemed to me in some cases to be of service under these circumstances. If it can be given in half-drop or drop doses every thirty minutes and carefully watched until the pupils dilate, there will sometimes be seen an improvement in the respiration. It probably acts by relieving spasm in the bronchioles and by acting as a respiratory stimulant.

Resolution.—Where there is a delay in resolution one of the best remedies is cod-liver oil and fresh air. Holt[1] says: "It has been our experience that the protracted cases lasting over a month are almost invariably fatal in the hospital, but often recover when transferred to the country convalescent home." It is in this stage, too, that tonics are of benefit. Iodine can be applied locally. The syrup of the iodide of iron is also of great service at this time.

After all that has been said regarding the treatment of broncho-pneumonia, it can be summed up in a very few words by saying that the treatment is rest, fresh air, nourishment, local applications, and,

[1] *Archives of Pœdiatrics*, April, 1896.

where needed, alcohol, strychnia, codeine, with perhaps vigorous stimulation to tide the patient over the impending collapse.

PLEURISY.

THE question of the etiology and treatment of pleurisy has been so critically and completely discussed by Matas in his article in Vol. II. that the present writer will merely touch upon a few of the more important points that have been brought out in the four years since that article was written. Some repetition will be unavoidable.[1]

I. FIBRINOUS, PLASTIC, OR DRY PLEURISY.

This form of pleurisy may follow exposure to cold, particularly in the case of debilitated subjects or in those of a rheumatic diathesis. In Bright's disease, diabetes, and other depressing diseases a dry, plastic form of pleuritis may occur. Whether this is due to chemical or microbic causes is not definitely known. Acute, localized, dry pleurisy may be due to tuberculosis. Accompanying inflammatory and neoplastic processes in the lungs, a secondary pleurisy is common, as in pneumonia, pulmonary abscess, cancer, gumma, gangrene, infarction, or tuberculosis whenever the disease reaches the surface of the lung.

The treatment of this condition will vary somewhat with the cause. The relief of pain is the main indication. Hot fomentations are commonly sufficient. At times the chest may be strapped as for fractured ribs, three or four long strips of adhesive plaster about two inches in width being tightly drawn about the affected side and passing beyond the median line both in front and behind. These strips should be neatly and evenly applied, overlapping in shingle fashion, and should be put in place during a forced expiration. Blisters, leeches, painting with tincture of iodine, may give some relief. The severity of the pain will at times demand morphine. In the cases where there is reason to suspect a rheumatic origin salicylates and alkalies can be tried.

De Cerenville [2] of Lausanne injects one to three cubic centimetres of sterilized olive oil into the pleural sac. He claims that the injection is not difficult and that the relief is prompt.

II. ACUTE SERO-FIBRINOUS PLEURISY, OR PLEURISY WITH EFFUSION.

These forms of acute and subacute pleurisy are classed, according to latest views, under the head of microbic affections. Cold and

[1] See also article by McCosh in this volume.

[2] Abstract in *Annual of the Medical Sciences*, 1896.

trauma are looked upon as but predisposing or favoring causes. Debilitated conditions and conditions of toxæmia—*e. g.* Bright's disease, diabetes, cirrhosis of the liver, or malignant growth—lessen the resisting power of the body and encourage the development of the organisms. It is impossible to exclude chemical—*i. e.* toxæmic—causes for some of the cases. The possibility of a primary toxic cause, with a secondary microbic affection, has also to be considered.

Various organisms have been detected in the exudate. Among the commoner of these are the pneumococcus of Fränkel, the streptococcus, the staphylococcus, the tubercle bacillus.

Tubercular Nature of Pleural Effusion.—There has been a decided tendency among clinicians, bacteriologists and morbid anatomists to look upon the great majority of serous pleural effusions as of tubercular origin. The hereditary history, the previous personal history, co-existing evidences of pulmonary or peritoneal tuberculosis, the subsequent histories of these patients, the autopsy, the tuberculin test, the bacteriological examination of the fluid, have been the grounds upon which numerous observers have reached the conclusion that a large number—a large majority, some say—of serous pleurisies are tubercular. Among those who report large percentages of tubercular pleurisies may be mentioned Netter, Eichhorst, Landouzy, Ricochon, Kelsch and Vaillard, Chauffard, Levy, Prince Ludwig Ferdinand, Jakowski, Aschoff, Thue, Sejournet, and others. Aschoff[1] concludes that the so-called idiopathic pleural exudates are almost without exception of a tuberculous origin.

A mistake is not uncommonly made by physicians in examining a pleural exudate and excluding tuberculosis because the bacilli are not found. It is the exception to find the bacilli in cover-slip preparations. Few culture experiments are successful, and a negative result in an inoculation experiment is by no means conclusive evidence against the tubercular origin of the pleurisy. It is said that 32 per cent. of inoculations with tubercular exudates give a negative result.[2] In this connection Eichhorst's[3] experience may be instructive. In a series of cases he tried inoculations with the serous exudates, but was unsuccessful in inducing tuberculosis in the animal, though he was sure in some of the cases that the fluid had been taken from a tubercular pleural cavity. In a second series, however, he used a larger quantity, 15 c.c. instead of 1 c.c. in his injections into the abdominal cavity, with the result that tuberculosis developed in 65 per cent. of the animals. These views are held by the majority of the French school. Germain Sée expresses perhaps the strongest

[1] "Zur Aetiologie der serösen Pleuritis," *Zeit. f. klin. Med.*, Bd. xxix. S. 449.

[2] Aschoff, *loc. cit.*; also Netter, *Charcot's Traité de Méd.* vol. iv. p. 981.

[3] *Correspondenzblatt für Schweizer Aerzte*, 1895, No. 13.

sentiments when he "regards pleuritics as patients afflicted with tuberculosis in an evolutionary stage, and recommends that they should be treated in the same manner as consumptives."[1]

The more one investigates cases of sero-fibrinous pleurisy, and the longer one's patients are under observation, the more do clinical facts and the subsequent histories bear out the notion that the "idiopathic" pleurisies are very largely tubercular. The subsequent histories of cases observed by Fiedler, Barrs, Ricochon, and Bowditch showed a surprisingly large number with later unmistakable tuberculosis. Osler, while apparently hesitating to accept fully the conclusions of the French, admits that the more he has studied the question the larger does the proportion appear to be of primary pleurisies of tuberculous origin.[2]

Suppuration in Effusion.—Do all pleurisies in which the so-called pyogenic organisms are found go on to suppuration? The correct answer to this question is not easily given. Aschoff, in the article from which quotation has already been made, in examining the exudates from 200 cases found 7 in which a positive result was obtained from a bacteriological examination. Two died soon after, and no autopsy was permitted. The remaining 5 went on to suppuration. Two had contained the pneumococcus and 3 the streptococcus. He reaches the conclusion that all or nearly all exudates in which pyogenic organisms are found will sooner or later show pus. As a possible exception is to be mentioned the pneumococcus exudate. The early death of the organism (*vide* article Pneumonia, p. 328) may account for the relatively benign course of these cases.

Other observers (Prince Ludwig Ferdinand, Goldscheider, Levy) observed cases in which no purulent metamorphosis occurred, though the pus-producers (streptococcus, pneumococcus, staphylococcus) had been demonstrated in the fluid. Almost all these observers agree that an exudate, in a so-called "idiopathic pleurisy," that is free from organisms in cover-slip preparations and that gives a negative result in cultures, is presumptively tubercular.

A case is to be regarded as *rheumatic* only when in connection with an acute rheumatic arthritis or in one who has had recurring attacks of rheumatism. In almost every instance, too, the endocardium or pericardium will be found involved.

A pleurisy, with or without effusion, occurring in *syphilitics* has been described by several writers (Chantemesse, Prätorius, Nikulin). It may be present during the secondary stage or later, and may be insidious or frank. It can be regarded as due to the efflorescence on the pleura of lesions similar to those on the skin, to a periostitis, or to

[1] Abstract in *Annual of the Medical Sciences*, 1893.

[2] *Practice of Medicine*, 2d ed., p. 593.

a pleural lymphangitis. Several observers agree that in some cases that have resisted ordinary treatment the rapid clearing up of symptoms under anti-syphilitic treatment is proof positive of the specific character of the inflammation.

Pleuritic effusion of a serous character may complicate or follow *pneumonia* and contain the pneumococcus. A very few cases of primary pneumococcal pleurisy with effusion not complicating pneumonia have been reported.

In *typhoid fever* the Eberth bacillus has appeared to cause a pleural exudate that was not purulent. A pleurisy in typhoid not infrequently suppurates, and is due to the ordinary pyogenic organisms or to the bacillus typhosus.

In *nephritis* the occurrence of pleuritic effusion may be regarded as due to microbes, though the possibility of a *chemical* (toxæmic) poison cannot be well eliminated.

It is probable that in some cases of pleurisy with effusion the inflammation is by extension, as where there is primary pericarditis. Some of the pleurisies found with valvular disease are due primarily to pulmonary infarction.

Treatment.

The treatment of sero-fibrinous pleurisy must be discussed under the heads of local treatment, medicinal treatment and operative treatment.

1. Local Treatment.—This is directed mainly to the relief of pain and the lessening of the exudative process. Little can be done to lessen the amount of exudate. The application of blisters and of leeches has very little effect. In some cases of pleurisy, even if the effusion is large, severe pain is complained of, particularly at the upper border of the effusion. Hot fomentations, blisters, leeches, dry cups may give relief. At times painting the side with tincture of iodine is of benefit. The severer cases will, of course, demand the use of opium.

2. Medicinal Treatment.—By restricting the diet to the drier articles of food and by keeping the bowels freely open, particularly with a morning dose of salts, some effusions will quite rapidly disappear. The time-honored treatment by the use of diuretics and cathartics is of benefit in some cases. But harm can come if patients are purged too freely, as they are in that way weakened. It is better and more rational treatment in some cases to build up a patient by the use of tonics, cod-liver oil, hypophosphites, etc. than to cause him to lose strength by purgation in the vain hope of carrying off the effusion. In cases where the effusion is in connection with heart disease the use of cardiac tonics such as digitalis, strychnine and strophanthus

is indicated. Diuretin, or calomel used for the diuretic effect, will sometimes be found of benefit. In cases occurring in association with rheumatism the salicylates and the alkalies are to be recommended. While the list of those who advocate the use of salicylic acid in rheumatic pleurisy is very large, in practice the number of suitable cases is so small that we see but very few relieved by this method of treatment. The rare cases of syphilitic pleuritis should be treated by the proper anti-syphilitic methods. They are said to respond readily, the effusions rapidly disappearing.

3. Operative Treatment.—It is too sweeping a statement to say that every pleuritic effusion should be treatment by aspiration, but in practice nearly every pleural effusion will be benefited by aspiration. There is really no harm in performing a too early thoracentesis. Even though the chest rapidly refills, no damage has been done. There may be danger in performing the operation too late. Not a few cases of sudden death are reported where large effusions have been present in the chest; and the danger that comes from too long continued compression of the lung and from adhesions formed in an unfavorable position should not be overlooked. It may be taken as a general rule that any effusion that is three weeks old and does not show signs of lessening in amount should be aspirated. A still shorter period should be allowed in the case of children. It should not be forgotten, however, that many effusions of large extent will spontaneously disappear quite rapidly. This is particularly true in children, in the effusions following pneumonia. As urgent symptoms demanding immediate aspiration should be mentioned dyspnœa with cyanosis. Also the immediate operation should be done when the amount of fluid is large—when it is as high as to the third rib in front. Even if the operation is to be repeated, it should be done at once. It is astonishing how a small amount withdrawn will sometimes favor rapid absorption of the remainder.

It is not necessary to describe the details of the operation. This has been fully done by Matas in Vol. II. and by McCosh in this volume. It may not be out of place to repeat a few practical points:

(1) There should be strict asepsis, the field of operation being thoroughly cleansed, the instruments being boiled. This does away with the very slight danger of infecting the fluid and causing subsequent suppuration.

(2) It is much better to use a guarded needle than one with a free, sharp point. In the hands of an expert an unguarded needle may be a source of very little danger, but the possibility of wounding a lung or the diaphragm or some vessel should be reduced to a minimum.

(3) The best place to aspirate varies somewhat with the amount of fluid. In general the seventh interspace, in the mid-axillary line

or a little posterior to this, in the eighth interspace, will be found the best location.

(4) It is scarcely necessary to call attention to the necessity of avoiding puncture of the lung, the liver, the heart, the spleen, or the diaphragm. I have known of instances in which the liver, the spleen, and the diaphragm have been punctured in this operation. One should remember also that as the fluid is withdrawn the diaphragm ascends and may come in contact with the needle.

(5) If one is firmly convinced of the presence of fluid he must persist in the attempt to aspirate, even though the first one or two insertions of the needle give a dry tap. Plugging of the needle with a bit of fibrin, the encysted nature of the fluid, or some local condition not clearly recognized may explain the failure to get fluid at the first attempt.

(6) The amount of fluid withdrawn should not, in general, exceed 1500 c.cm. In fresh cases, where the lung readily expands, more may perhaps be withdrawn with safety ; but in old cases, where the lung has been long compressed, where there may be adhesions, it is unwise to withdraw more than the amount specified. The writer has known of a rupture of the lung that followed the withdrawal of something over two quarts. He has seen a rapid congestion of the lung with the albuminous expectoration of the French, and a fatal result, follow the withdrawal of a quart and a half of fluid in the case of an old man with valvular heart disease, nephritis, and pleurisy.

The *dangers* from an aspiration are in reality very slight when the operation is done with ordinary care. Very rare instances of sudden death have been reported. Puncture of organs can be avoided by the exercise of care in the insertion of the needle. With proper precautions infection of the fluid should not occur ; the little air that enters can be practically disregarded, as air-infection is no more a source of danger than in opening the peritoneal cavity. It should be remembered that if suppuration does occur later, it is not, of necessity, due to faulty aspiration. Many a case of pleural effusion goes on to suppuration without an aspiration having been performed. The danger also of the sudden congestion of the lung with the albuminous expectoration described by the French is not to be forgotten. Indications to stop should be the withdrawal of a thousand to fifteen hundred cubic centimetres, severe coughing spells, syncope, severe pain, or weak pulse.

The importance of a *bacteriological examination* of the fluid is self-evident. This is less important, perhaps, on the score of immediate treatment than for prognosis, for where the effusion is large or where it fails to disappear under ordinary therapy the treatment will be thoracentesis, regardless of the bacteriological finding. But as

regards prognosis and subsequent treatment the bacteriological diagnosis is of importance. This is particularly true as regards the subsequent treatment of cases found to be tuberculous. Here a change of climate and the ordinary treatment for tuberculosis will, of course, be in order. Following the evacuation of the fluid the patient should, if at all run down, be given tonics, nourishing food, fresh air. If tubercular, cod-liver oil, change of climate, and the treatment proper for tuberculosis should be prescribed. Exercise, particularly exercise tending to expand the lungs, or massage of the chest may tend to hasten the absorption of fluid that remains, or at least prevent the refilling of the chest.

DISEASES OF THE HEART.

By FREDERICK P. HENRY, M. D.

The subjects of this section are treated in the following order:

Diseases of the Pericardium: Pericarditis; Hydropericardium; Hæmo- and Pneumo-pericardium; Synechia Pericardii.

Myocarditis: Acute Diffuse Myocarditis, Sclerotic Myocarditis.

Acute Ulcerative or Malignant Endocarditis.

Simple Endocarditis.

Symptoms Common to All Forms of Valvular Disease: Dyspnœa; Digestive Disorders; Urinary Changes; Œdema; Embolism.

Treatment of Simple Endocarditis: Prophylaxis; Treatment of the Attack.

Treatment of the Results of Valvular Disease.

Schott Treatment of Chronic Heart Disease.

Medicinal Treatment of Valvular Heart Disease.

Treatment of Special Symptoms: Dyspnœa; Digestive Disorders; Œdema and Serous Effusion; Syncope; Embolism and Hæmorrhage.

Fatty Overgrowth and Infiltration.

Fatty Degeneration.

Neuroses of the Heart: Palpitation; Essential Paroxysmal Tachycardia; Bradycardia; Angina Pectoris.

Heart Disease and Pregnancy.

DISEASES OF THE PERICARDIUM.

Pericarditis.—The remarks concerning the prophylaxis of endocarditis (*q. v.*) are in all respects applicable to that of pericarditis.

In many cases of inflammation of the pericardium, such as those arising in the course of infectious diseases, pyæmia and septicæmia, Bright's disease, and scorbutus, the disease is so insidious and its symptoms so overshadowed by those of the primary affection that there are scarcely any indications for treatment. Every hospital physician of large experience has occasionally seen the pericardium covered with flakes of recent lymph in cases which, during life, had presented no cardiac symptoms whatever.

The acute form of pericarditis, of which alone there can be said to be a treatment, most frequently arises in the course of acute articular rheumatism, and may be one of its earliest manifestations. It is

of the utmost importance, therefore, that the physician in charge of a case of rheumatism should repeatedly examine the heart in order that he may obey the maxim, *Obsta principiis*, which in this disease is imperative.

When pericarditis manifests itself by a friction murmur, or when on account of pain in the region of the heart or palpitation occurring in the course of rheumatism, its presence is suspected, wet cups or leeches should be freely applied to the præcordial region. By the early employment of such measures it is believed that the course of pericarditis may possibly be cut short, and certainly favorably modified. An ice-bag should then be applied to the same region, and its use continued as long as it is grateful to the patient's sensations. Bäumler has kept up the application of ice for a week,[1] but in the opinion of the writer it is doubtful whether its effect continues beneficial after forty-eight hours. By the combined employment of local bleeding, ice, and absolute rest cardiac excitement is quieted, pain subdued, and, consequently, sleep promoted.

When the scarifications or leech-bites have healed, if signs of effusion are present a blister three or four inches square should be applied. Although this measure is disapproved of by some writers and "damned with faint praise" by others, I am convinced from clinical experience of its efficacy.

The internal treatment of pericarditis depends upon the indications presented by the individual case. If the heart is excited and tumultuous, it may be calmed by the tincture of aconite (two or three drops every two or three hours) in association with the bromide of sodium or potassium, and if pain and insomnia are present a salt of morphine, in the dose of from $\frac{1}{24}$ to $\frac{1}{12}$ grain, may be added to the mixture. On the other hand, if from the coexistence of valvular disease or other cause the heart shows signs of incompetence, digitalis or strophanthus should be given from the start. Modern opinion is opposed to the administration of calomel to the point of salivation with the object of exciting a specific effect upon the inflammatory process, but no one can deny its value as a laxative, and for this purpose it may be prescribed in small, frequently repeated doses. The iodide of potassium, either alone or with the tincture of digitalis, is a drug which may be given with advantage at all stages of the disease. In small doses—five to ten grains—it is a recognized heart tonic and analgesic, and is universally believed to promote the absorption of inflammatory products.

The further treatment of the case depends upon the presence or absence of effusion. If at the end of two or three weeks pericardial effusion is manifest, vesication should be repeated, and diuretics, such

[1] *Handbuch der speciellen Therapie innerer Krankheiten.*

as caffeine and diuretin, together with concentrated saline purgatives, should be exhibited. If the effusion still persists and dyspnœa becomes urgent, with cyanosis, distention of the veins of the neck, and a pulse rendered intermittent by inspiration (*pulsus inspiratione intermittens*), paracentesis of the pericardium in case the effusion is serous—incision and drainage if it is purulent—should be performed. For the details of these operations the reader is referred to treatises on surgery.[1]

Hydropericardium.—Serous effusion into the pericardial sac almost invariably occurs as part of a general dropsy caused by heart, lung, or kidney disease, and is of subordinate consequence. Occasionally, however, the effusion in this situation is so great as to demand paracentesis, which, under the circumstances above mentioned, can only be palliative.

Hæmopericardium and Pneumo-pericardium are symptoms of diseases, such as aneurism, cancer of the œsophagus, pyo-pneumothorax, pulmonary tuberculosis, etc., of which they precipitate the fatal termination. Their treatment is included in that of the primary disease.

Synechia pericardii (*Symphysis pericardii*), adhesion of the pericardial layers, may be attended with no symptoms whatever, or, on the other hand, may gradually give rise to the most serious circulatory disturbances, analogous in all respects to those of failing compensation from other causes. The condition may be diagnosticated by the exclusion of all other causes of venous stasis—such as emphysema, valvular disease, and fatty degeneration of the heart—and by the anamnesis—history of acute pericarditis. In addition, certain positive signs, such as systolic retraction of the præcordium and diastolic collapse of the cervical veins, should be carefully looked for.

The TREATMENT is practically identical with that of failing compensation from valvular disease, *q. v.*

MYOCARDITIS.

MYOCARDITIS occurs in two forms—the acute and chronic—of which the former may be subdivided into suppurative and diffuse.

Acute suppurative myocarditis is very rare, and is but one of the localizations of a general septicæmic or pyæmic process.

Acute diffuse myocarditis has been observed in the course of most of the infectious diseases, especially typhoid and the eruptive fevers. Since the introduction of the cold-bath treatment of typhoid fever myocarditis has greatly diminished in frequency. Many years ago—in the "seventies"—I frequently encountered cases of typhoid

[1] *Paracentesis of the Pericardium*, by Dr. John B. Roberts, Philadelphia, 1880, may be consulted with advantage.

fever presenting symptoms of which I see and hear very little at the present time. Some of these cases were fatal, death being preceded by a marked tachycardia of two or three days' duration. Others recovered after a protracted convalescence, during which the pulse-rate was habitually over 100, sometimes nearer 120. It is of course permissible to suppose, in the absence of anatomical evidence, that the symptoms of these cases were quite as likely due to nervous derangement—for example, paralysis of pneumogastric—as to myocarditis. I incline, however, to the latter diagnosis, because of the constancy of signs of myocarditis—especially cloudy swelling—in cases of infectious disease which during life had presented marked signs of "irritable weakness" of the heart; and, further, because the symptoms during the protracted convalescence of the favorable cases are just what one would expect from a disease recovery from which involves a more or less complete involution of the cardiac muscle. On the other hand, the hypothesis of nervous derangement, although much might be said in its favor, has no anatomical basis whatever.

That there is such a disease as acute myocarditis of course no one denies.[1] The only question is to recognize it where present and to treat it properly. Without entering into further diagnostic details, which would be here out of place, I would call attention to "muffling of the heart sounds" as a symptom of primary importance upon which Maclagan lays the greatest stress.

Acute diffuse myocarditis being recognized or suspected, the patient should be kept at absolute rest, and if the heart is excited, and especially if fever is present, an ice-bag may be applied tentatively to the chest. If its effect is beneficial and the sensation of cold grateful to the patient, it may be continued for one or more days. In the same way—*i. e.* tentatively—alcoholic stimulants in moderate dose may be exhibited. Their effect is sometimes decidedly calming and at the same time strengthening. Individual idiosyncrasies with reference to alcohol are, however, so great that nothing positive can be predicated concerning its use. Digitalis, sparteine, caffeine, the bromides, valerian, ether, and strychnine, all find their applications in individual cases. During convalescence a nourishing, non-stimulating diet, into which milk enters largely, combined with general and local massage[2] and the internal use of iodide of potassium in small doses, strychnine, and iron, are the therapeutic measures from which good results may be confidently expected.

Chronic interstitial or sclerotic myocarditis is generally overlooked, or, at the most, its existence is merely suspected. It arises secondarily to sclerotic vascular changes, and may form the basis of a

[1] For a typical example of the disease, with account of autopsy, see *Maclagan on Rheumatism*, ed. 1881, p. 169.

[2] Vide *Massage des Herzens*, by Oertel.

cardiac aneurism. The only cases which afford any prospect of benefit from internal medication are those of syphilitic origin, in which mercurials and iodides, especially the latter, should be perseveringly employed. The symptoms to which it gives rise are very vague, and, when most pronounced, consist of dyspnœa and cardiac oppression or pain on slight exertion, and arrhythmia. It is an occasional cause of sudden death in individuals of sedentary life who are suddenly called upon to make some exertion which, to a sound individual, would be considered trivial.

ENDOCARDITIS.

Acute Ulcerative ("Malignant" Endocarditis).

The treatment of this disease, which is regarded as inevitably fatal, must of necessity be limited to prophylaxis and palliation. With reference to the former a brief mention of the causes of the affection is appropriate.

Ulcerative endocarditis is an inflammation of the endocardium produced by the agency of micro-organisms. Its inflammatory products are distinguished by their tendency to necrosis and disintegration, which renders them liable to be swept along the blood-current and give rise to multiple foci of inflammation in various tissues and organs. It was first described by Virchow in association with puerperal fever, and believed by him to be due to microbes. The latter may gain entrance through wounds apparently trivial, such as those caused by paring a corn, opening a furuncle, frost-bites, etc. It is most frequently observed as a complication of infectious diseases, such as puerperal fever, the infectious exanthemata, pneumonia, diphtheria, diseases of the bones, and acute articular rheumatism. It is most frequently associated with pneumonia: in about 25 per cent. of the recorded cases this association was observed.

Suppurative processes in any part of the body may cause it. Thus it has been seen in cases of empyema, pyelonephritis, suppurative inflammation of pelvic organs, inflammation of the gall-bladder, etc. It is called "spontaneous" when neither wound nor inflammatory focus can be detected, but such a thing as spontaneous or idiopathic ulcerative endocarditis is, with our present knowledge of infectious processes, scarcely conceivable.

Among the multiplicity of symptoms to which this disease gives rise, three types may be recognized: (1) a typhoid type; (2) an intermittent type; (3) cases of which the chief symptoms are referable to some particular organ. The two first named are, for present

purposes, sufficiently described by their names. In the third variety signs of serous inflammation (of joints, pleura, or peritoneum) may predominate and divert attention from the true seat of disease, or the disorder may assume the clinical picture of cerebro-spinal meningitis, with high fever, delirium, rigidity of cervical muscles, retraction of head, and automatic movements.

Hemiplegia may be the first symptom to excite alarm, being caused by embolic plugging of a large cerebral vessel; or a single cranial nerve, such as the facial, may be paralyzed, the cause in this instance being an embolism of "miliary" dimensions.

Psychical disturbances may predominate and simulate acute mania; in fact, there is a recorded instance of a case of ulcerative endocarditis being sent to an insane asylum.

From this brief description of the multifarious symptoms of ulcerative endocarditis it is manifest not only that it affords abundant scope for the palliative resources of the practitioner, but that it is impossible to formulate a plan of treatment that is applicable to all cases.

The general treatment of this disease is, practically, that of septicæmia. The strength is to be maintained with nutritious food and alcoholic stimulants, of which there is often a remarkable tolerance; pain and restlessness subdued by opium and its derivatives; insomnia combated with paraldehyde, sulphonal, trional, and the bromides; and the heart's action maintained by digitalis, strychnine, caffeine, and sparteine. Quinine, salicylic acid, and benzoate of sodium (1 gramme every hour) have been given with a view to destroy the microbic agents of the disease, but, it must be acknowledged, in vain.

Rare cases of supposed recovery from this disease are recorded, of which the most authentic is reported by Eichhorst, the diagnosis being based upon signs of embolism of skin (petechial spots) and kidneys and painful swelling of joints, coinciding with the physical signs of valvular heart disease. The attack occurred after parturition, and recovery ensued after a tedious illness of several months' duration, signs of mitral insufficiency remaining. In this case, which was of the typhoid type, the patient having been sent to hospital with the erroneous diagnosis of typhoid fever, the medicinal treatment consisted chiefly of a pill of hydrochlorate of quinine and corrosive sublimate:

℞. Quininæ hydrochlor., gr. lxxv (5.0);
Hydrarg. chlor. corrosiv., gr. iij (0.2);
Pulv. althææ, q. s. ut ft. pil. No. xx.
Sig. One pill thrice daily, after food.

Simple Endocarditis.

The valvular lesions consecutive to endocarditis are practically incurable, if by cure we mean the disappearance not only of the

symptoms, but also of the signs of heart disease. Exceptional cases have been reported by Leyden and Eichhorst in which these conditions of cure have been fulfilled, and, coming from such sources, they must be regarded as authentic. One can readily understand how, as in one of Eichhorst's cases, an aortic insufficiency dependent upon the retraction of two aortic cusps may be repaired by the stretching of the third, and also how a mitral insufficiency may, by contraction, become converted into a stenosis. In the latter case, however, the remedy, if such it can be called, is no better than the disease, and in neither is the process under control. The question of the disappearance of a valvular murmur is always a delicate one, its presence or absence depending largely upon the existing degree of blood-pressure. It is a matter of common observation that the intensity of a murmur may vary within wide limits, so that most instances of reported cure will always be open to criticism.

The repair of valvular lesions being practically out of the question, our therapeutic efforts must, of necessity, be limited to their prevention and to the alleviation of the symptoms to which they give rise. It is indispensable, therefore, that we consider, first, the causes of these affections; and, secondly, their consequences, and in so doing disputed and unsettled questions of bacteriology will be strictly ignored.

Excluding congenital anomalies, the immediate cause of every valvular lesion is endocarditis, which may be acute, subacute, or chronic. With the acutest form of this disease, the malignant or ulcerative endocarditis, we are not at present concerned. It undoubtedly causes extensive valvular defect, but the general symptoms of infection to which it gives rise, or is secondary, are so preponderant and so grave that the cardiac disease is of secondary consideration. Besides, as indicated by the term "malignant," this form of endocarditis is almost inevitably fatal, and its course is, as a rule, so rapid that the usual symptoms of cardiac incompetence have not time to develop.

By far the most frequent cause of the simple or non-malignant form of endocarditis is acute articular rheumatism. It is the tendency of rheumatism to affect the fibrous structures of the heart, which makes it one of the most serious diseases that the physician is called upon to treat, and gives to his prognosis of ultimate restoration to health a large degree of uncertainty. The frequency with which rheumatism is complicated with endocarditis is variously estimated. By Bamberger endocarditis is said to occur in 20 per cent. of the cases of rheumatism; by others it has been stated that from 50 to 60 per cent. of all cases of rheumatism are accompanied or followed by endocarditis or pericarditis, or both. It is evident that the "personal

equation" is concerned in the formation of such widely varying opinions. The more acute the attack of rheumatism the greater is the liability to cardiac complications. These are also more common in the young than the middle-aged. Endocarditis is the most frequent cardiac complication of rheumatism, and is almost invariably left-sided. The reason of this preference is that the valves of the left side are subject to much greater strain than those of the right. It is a curious fact that while acute rheumatic inflammation gives rise to great pain on the slightest movement of the affected joint, the same process in the valves of the heart, which are in continual movement, is often attended with no pain whatever. Another and most unfortunate difference between these structures is that, whereas the joint-inflammation is, as a rule, completely recovered from, that of the valves of the heart rarely, if ever, can be. It has been stated in explanation of the latter fact that the products of the joint-inflammation are absorbed on account of the counter-pressure exercised upon them by the surrounding solid structures, whereas, in the valves which are freely movable in the heart, the products persist on account of the absence of this salutary counter-pressure. A much simpler and more correct explanation is that which attributes the recovery of the joints to the rest which is enforced upon them by acute pain, whereas the heart not only gets no rest, but, owing to the febrile condition of the system and the irritation of its tissues, is actually compelled to do an unusual amount of work.

Next in frequency to rheumatism as a cause of endocarditis comes scarlatina, which is said to give rise to valvular disease either directly, or indirectly through the medium of arthritis, in 10 per cent. of the cases. Other infectious diseases which are occasionally followed by endocarditis are variola, erysipelas, measles, and gonorrhœa. The latter, like scarlatina, may be immediately followed by inflammation of the fibrous structures of the heart, or an articular inflammation may intervene.

The above are the universally recognized causes of endocarditis in general, but there are certain special valvular defects in the etiology of which other factors are undoubtedly operative. In the causation of mitral stenosis, for example, the influence of sex has attracted the attention of all observers. About 70 per cent. of the cases of mitral stenosis occur in females. This fact has as yet received no satisfactory explanation. Rheumatism is more common in girls than in boys, but this would explain a preponderance of all kinds of valvular disease in women, and not of this particular condition. Anæmia is a recognized cause of valvular disease, and anæmia is certainly more prevalent in females than in males. Anæmia also causes slowly progressive rather than acute forms of valvular disease, and it is the

slowly progressive forms of inflammation that lead to mitral stenosis. The more frequent combination of rheumatism and anæmia among women is probably the cause of the preponderance of mitral stenosis in the female sex. It is true that we often encounter cases of mitral stenosis in which no history of articular rheumatism can be elicited, but it should be borne in mind that there are other manifestations of rheumatism than inflammation of the joints. For example, there can be little doubt that many cases of tonsillitis are rheumatic, as is evidenced not only by their yielding to the remedies which are most efficacious in the treatment of rheumatism, but also by their being occasionally followed by endocarditis. Erythema nodosum is another affection which is generally believed to be a manifestation of the rheumatic diathesis, and there is good reason for believing, with Abraham Jacobi, that the so-called growing pains of adolescents are often of rheumatic origin. We should not, therefore, in cases of valvular disease assume the previous absence of rheumatism merely because the patient has never suffered from acute arthritis. At the same time, it must be admitted that in the etiology of a certain number of cases of mitral stenosis the influence of rheumatism is either traced with difficulty or is absent.

The same is true of disease of the aortic valves, in the causation of which atheroma—which, in its turn, may depend upon syphilis, alcoholism, gout, over-exertion, or senility—is a frequent factor. In this connection I may call attention to the tradition that valvular heart disease and pulmonary phthisis are mutually exclusive, and, so far as the mitral valve is concerned, I believe it to be well founded. A lung flushed with oxygenated blood, as in cases of mitral disease, does not afford a favorable soil for the tubercle bacillus. In my experience the valvular affections associated with pulmonary phthisis have been almost invariably aortic. In such cases the valvular disease is usually atheromatous, and is secondary to similar degeneration of the aorta. As is well known, there is, to say the least, no antagonism between atheroma and phthisis.

Symptoms Common to All Forms of Valvular Disease.—Every form of valvular disease tends to produce an accumulation of blood on the venous side of the circulation: in a word, venous congestion. This may be prevented for an indefinite period by what is technically known as "compensation." A valvular disease is said to be compensated when there are neither symptoms nor signs of venous congestion. Compensation is effected by hypertrophy of one or both ventricles. In aortic disease, whether this be in the nature of stenosis or insufficiency, the hypertrophy by which compensation is made for the valvular defect affects chiefly the left ventricle, whereas in mitral disease of either kind the hypertrophy affects chiefly the right ven-

tricle. Compensation may be disturbed in various ways. It is self-evident that a heart which is capable of maintaining the circulation when the patient is leading a regular, tranquil existence may be absolutely incompetent under circumstances demanding greater activity of body or mind. The most frequent cause of disturbed compensation is over-exertion, such as running, climbing long flights of stairs, lifting heavy weights, dancing, swimming, rowing, and the like. Mental disturbances, such as those dependent upon fright, grief, and anxiety, are almost equally efficacious in destroying the vascular equilibrium. The abuse of tea, coffee, tobacco, and alcohol, or, in many cases, the mere use of these substances, tends, although more imperceptibly, to the same result. There are certain states, both physiological and pathological, in which the demands upon the circulation are often such as to severely tax the activity of a healthy heart. The chief of these are the infectious fevers, pulmonary diseases, pregnancy, and parturition. As a matter of course, a heart which is employing most of its reserve force in maintaining the circulation is speedily rendered incompetent by any of the complications above mentioned.

Dyspnœa.—The earliest symptom of cardiac disease is dyspnœa. This may not be apparent, either subjectively or objectively, when the patient is quiescent, but is induced by an amount of exercise so slight as scarcely to accelerate either pulse or respiration in a healthy individual. The dyspnœa is often combined with bronchitis, both being dependent upon pulmonary congestion. Under such circumstances the patient generally attributes his dyspnœa to bronchial catarrh, and the physician who is not systematic in his clinical examination may be misled into this supposition. The dyspnœa, although habitual, may be aggravated in paroxysms to which the name *cardiac asthma* is often loosely applied. There is nothing incompatible between valvular heart disease and spasmodic asthma, but, unless attacks of dyspnœa are attended with sibilant and sonorous râles, inspiratory position of the thorax, and prolonged expiration, they cannot justly be called asthmatic. Most of the so-called attacks of "cardiac asthma" are associated with and caused by palpitation of the heart, which, in its turn, is due to some unusual physical exertion or mental excitement, to gastro-intestinal disorder, or to the recumbent position. It is doubtless partly owing to the latter cause that the attacks are often nocturnal, the patient being suddenly roused from sleep by a sense of impending suffocation.

As the heart grows more and more incompetent the dyspnœa becomes constant, until at last, for days or even weeks preceding death, the patient is unable to lie down, but passes his nights seated in one chair, with his arms resting on the back of another. That

peculiar form of respiration to which the names of Cheyne and Stokes have been applied (the so-called Cheyne-Stokes respiration) is often seen in the last stages of valvular disease of the heart. On close inspection it will be observed that there are times when the respiratory movements come to a complete standstill, and that these periods of cessation occur at regular intervals. For half a minute or more no signs of respiration can be detected, and, strange to say, while this vital function is held in abeyance, the patient may exhibit no signs of distress whatever. Suddenly respiration is resumed with a slight gasp, and at first seems to proceed in a regular manner. Very soon however, the respirations may be observed to increase in depth and frequency on a regularly ascending scale, until the maximum in these respects is reached. They then become gradually slower and shallower, until again they cease entirely. This phenomenon may be observed for many days before death. It is not peculiar to cardiac disease, but is also seen in affections of the brain and kidneys. It is supposed to be due to variations in the excitability of the respiratory centre from rhythmical alterations in its supply of blood.

Digestive Disorders.—In health, the sense of repletion which follows the ingestion of food is partly due to congestion of the vessels of the gastric mucosa, and therefore in heart disease, in which there is more or less stasis of the portal blood-vessels, anorexia is the rule. The congestion of the portal system is more marked in mitral than in aortic lesions, and consequently it is in the former that the symptoms of "cardiac dyspepsia" are most pronounced. Post-mortem evidences of catarrh of the gastric mucosa are commonly found. The lining membrane of the stomach is covered with a layer of tenacious mucus, which being removed shows the underlying tissue to be congested, infiltrated with serum, suffused with extravasated blood, and sometimes riddled with a multitude of minute erosions. It is evident that such a state of the stomach must be highly unfavorable to nutrition, and it is probable that it is largely responsible for the anæmia which is so common an attendant of valvular heart disease, and which was designated many years ago by Andral by the title *cachexie cardiaque*.

The portal congestion is further manifested by enlargement of the liver and by a sense of weight and tension in the right hypochondrium, or even by tenderness or pressure in this region. The spleen is much more seldom demonstrably enlarged. Icterus is by no means rare in advanced stages of valvular disease, and may be due to hepatic congestion or gastro-duodenal catarrh, or to a combination of both of these causes. Hæmorrhoids, leucorrhœa, menorrhagia, and retinal hæmorrhages have all been observed in the course of cardiac valvular disease, and are to be ascribed to the obstruction of the return of venous blood.

Urinary Changes.—The urinary secretion presents certain characteristic alterations which are significant of renal congestion, no matter how produced. In heart disease with deficient compensation, in emphysema, and in asthma—in short, wherever there is chronic obstruction to the return of venous blood to the heart—the renal secretion displays, in greater or less degree, the following characters: In the first place, it is diminished in quantity. Secondly, and as an almost necessary consequence, its color is deeper, and it deposits, on standing, a more or less copious precipitate of uric acid and urates. This does not indicate an increase in the total diurnal amount of these substances; on the contrary, they are diminished, but not in the same proportion as the water—they are relatively in excess. The total diurnal amount of urea is also less than normal, although also relatively increased. In other words, in an ounce of the "urine of congestion" there may be more uric acid, more urates, and more urea than in the same amount of normal urine, but the total number of ounces of the former is so much less than normal that the amount of solids which it carries out in solution is greatly reduced. According to Senator, the diminished amount of urea may be partly due to the fact that this substance passes into the dropsical effusions and is also excreted, in the diseases above mentioned, by the intestines.

It is often stated and accepted without question that the urine of congestion contains blood and an abundance of albumin, but such statements, which are the result of deductions from experiments on animals, are far from being confirmed by clinical facts. So long as the condition of the kidney is that of mere congestion the albuminuria is slight. As to hæmaturia, it is scarcely ever present in macroscopic amount, and it is only in a minority of cases that red blood-corpuscles can be detected with the microscope. The scanty blood-corpuscles occasionally found are probably derived from the hyperæmic mucous membrane of the renal pelvis and not from the renal parenchyma. Hyaline casts may also be present. In course of time the congestion may give rise to nephritis, in which event the albuminuria will be decidedly increased. The peculiarities of the urine of congestion are due to diminished arterial pressure. This is proved by the fact that when the heart's action is strengthened by digitalis or other cardiac tonic, the abnormal characters of the urine often entirely disappear. The secretion becomes increased in quantity, often enormously so, the albuminuria disappears, and the urates, the uric acid, and the urea become relatively diminished and absolutely increased.

Œdema.—Sooner or later, in most cases of heart disease œdema sets in. It is largely mechanical, as is proved by the fact that it first appears in the most dependent portions of the body; but not

entirely so, since it undoubtedly occurs earlier in the anæmic than in those who are comparatively well nourished. It is first observed in the evening, especially in those who are obliged to stand while at work, and disappears entirely during the night. It gradually appears earlier in the course of the day and at last a stage arrives when it is constantly present. If life is sufficiently prolonged, the œdematous infiltration creeps slowly upward until the thighs, the genital organs, the trunk, upper extremities, and face are involved. The ultimate result of the obstruction to the circulation is effusion into the serous cavities, these being usually involved in the following order: peritoneum, pleura, pericardium, ventricles of the brain, and subdural space. The existing dyspnœa is greatly increased by effusion into the two first-named cavities, the result being, in the one case, interference with the descent of the diaphragm, and, in the other, compression of the lung. The effect of gravity upon the disposition of the œdematous fluid is well seen in patients who lie habitually upon one side. On the dependent side of the trunk the tissues are swollen and pit deeply upon pressure, while in the corresponding tissues of the opposite side pitting is slight or absent.

In extreme degrees of œdema the skin of the lower extremities is sometimes raised into vesicles or blebs which rupture and become the sites of a constant oozing of fluid. I have also seen this occur in the upper extremity. Erysipelatous inflammation and even gangrene may have its starting-point in the ruptured portions of integument.

Embolism is an accident liable to occur in all cases of valvular heart disease, and may have its seat in the pulmonary circulation or in that of the general arterial system. In the former case it gives rise to the symptoms and signs of hæmorrhagic infarction of the lungs (*apoplexia pulmonum*), the chief of which are sudden pain in the chest, dyspnœa, and hæmoptysis. The auscultatory phenomena, which are only present when the infarct is of considerable size and superficially seated, are identical with those of pneumonic consolidation in general.

In the extremities the onset of embolism is indicated by sudden pain and a sense of weakness in the affected limb, sometimes also by numbness or paræsthesia. Below the obstruction the vessel is pulseless until the collateral circulation is established. Of the lower extremities the left is more often the seat of embolism, because the left iliac artery is more nearly parallel with the aorta than the right. If the circulation is suddenly cut off from both lower extremities the accident is probably due to embolic obstruction of the aorta, although instances are recorded in which both iliacs have been simultaneously occluded.

The spleen and kidney are the favorite seats of embolism. In the former the accident may be signalled by sudden pain and tenderness

in the left side, accompanied with rise of temperature, vomiting, and splenic enlargement; while in the kidney it is manifested by lumbar pain and by hæmaturia.

Embolic occlusion of the superior mesenteric artery gives rise to sudden abdominal pain and signs of collapse, followed by the passage of blood-tinged stools. The superior mesenteric artery being a "terminal" vessel, its obstruction is followed by extensive hæmorrhagic infarction of the intestinal mucosa.

The most serious consequences result from embolism of the cerebral vessels, of which the one most frequently occluded is the left Sylvian artery. The greater frequency of left-sided embolism of the brain is due to the fact that the innominate artery springs from the aortic arch at almost a right angle while the course of the left carotid is nearly in line with the blood-current.

Apart from gross alterations of cerebral structure, such as those produced by embolism, patients with heart disease often exhibit symptoms directly referable to the brain. They become moody, irritable, or melancholic, and may even have transient attacks of delirium or mania. The functional disturbances are undoubtedly dependent upon the disordered state of the cerebral circulation. The statement has been made that melancholia is apt to be associated with affections of the mitral valve, while those of the aorta are more prone to be attended with symptoms of irritation.

Treatment of Simple Endocarditis.—In discussing the treatment of valvular diseases we have first to decide whether there is any means of preventing the endocarditis upon which they depend. Next in order comes the therapeutics of the endocarditis itself, and, finally, that of the circulatory disorders, and their results, to which the valvular imperfections give rise.

1. *Prophylaxis of Endocarditis.*—Of the various diseases which give rise to endocarditis there is but one—acute articular rheumatism—for which there is a specific treatment; so that the question whether we can prevent an inflammation of the endocardium is practically identical with that of our ability to prevent the involvement of a particular joint. In many cases of rheumatism endocarditis is present and recognized by the physician at his first examination of the patient; in others it is present, but not sufficiently advanced to make its presence known by signs; and I believe also that there are good grounds for the opinion that rheumatic inflammation may attack the heart primarily, constituting the *endocardite rhumatismale d'emblée* of French writers. In cases such as these the time for prophylaxis has gone by, but this fact is only patent when the endocarditis is recognized. When it is latent, *i. e.* not sufficiently advanced to interfere with valvular function, and manifests itself at a comparatively late

period, the conclusion seems to be warranted that the specific anti-rheumatic treatment has been useless, so far as the prevention of endocarditis is concerned. Nevertheless, this conclusion, under such circumstances—and I believe them to be frequent—is manifestly false. I am not of those who hold that the benefits of the treatment of rheumatism with the salicyl compounds are limited to the relief of pain. The *argumentum ad hominem* is, in this instance, unanswerable, for no one who has suffered from an attack of acute articular rheumatism and *has treated it promptly* can fail to perceive the curative power of salicylic acid and its salts. There appears to be a law that the curative power of a specific method of treatment is in direct ratio to its early employment. We see this conspicuously in typhoid fever and diphtheria, and also, I believe, in rheumatism.

While, therefore, from the nature of things, there can be no proof in any given case of rheumatism that endocarditis has been prevented by treatment with the salicyl compounds, there is no doubt that such treatment is the only one to be relied on. There are those who are much more positive as to the prophylactic power of the salicyl treatment. For example, Professor Latham of Cambridge, England, states, as the result of such treatment, that in no case of rheumatism under his care during the course of six years was there developed, "when the heart was previously sound, any cardiac complication, such as endocarditis or pericarditis."

My own opinion of this question of prophylaxis is practically identical with that of Professor Whitla of Belfast, and I cannot express it more clearly than in the words of this well-known author: "Conflicting opinions prevail about the value of salicin or salicylates in preventing endocarditis. The writer has carefully watched the results of this treatment at the bedside, and has, as far as possible, kept an eye upon the patients afterward. His experience, though it does not lead him to believe that the salicylic acid treatment more than appreciably lessens the chance of endocarditis, nevertheless leads him to believe that it will be proved that a large proportion of the salicylic cases escape the more serious forms of valvular lesion."[1]

Absolute rest in bed, uniform temperature of the patient's apartment, and regular action of the bowels, are coincident measures of prophylaxis which should never be neglected.

Medical Treatment of Simple Endocarditis.—Supposing the presence of endocarditis to be recognized, the question at once arises whether we possess any means by which its course may be favorably modified, and it must be confessed that its solution is quite as difficult as that of the question of prophylaxis. Nevertheless we must act, and promptly, making use of such measures, both local and general, as

[1] *Dictionary of Treatment*, 1892, Lea Brothers & Co.

experience has seemed to prove of value. If quietude on the part of the patient has been previously relative, it must now be made absolute, and if the patient is not fully under the influence of salicylic acid, this drug or one of its salts should be continued in full doses until ringing in the ears and slight giddiness are produced. In addition, the bicarbonate of sodium or potassium or the citrate of the latter should be administered in doses of 20 grains every three or four hours. An effective and palatable method of giving the latter is an effervescing draught made by mixing a solution of potassium bicarbonate with lemon-juice. If the heart is excited in its action aconite will be found of service, and may be given with the bromide of potassium, as in the following prescription:

℞. Tincturæ aconiti, ♏xxiv (1.6);
Potassii bromidi, ʒij (8.0);
Aquæ camph., ad fʒiij (90.0).—M.
Sig. Two teaspoonfuls every two hours.

At the same time, at least one free evacuation of the bowels should be secured daily by the use of salines, such as magnesium sulphate, Rochelle salt, or Carlsbad salts. To children who object to such bulky and unpalatable doses, calomel may be administered. Stimulants are rarely needed, although when the patient is debilitated and anæmic both whiskey and ammonia may be employed with decided benefit.

Locally, cold and heat, rubefacients, vesicants, leeches, and belladonna are advocated. Although it cannot be demonstrated that the course of an endocarditis is modified by vesication of the præcordial region, the faith in blisters is still held fast by many well-known authorities.

The line of local treatment that I would recommend in cases of non-malignant endocarditis is the following: As soon as it is suspected that the endocardium is involved, cold in the form of an ice-bag should be applied to the præcordium. At the end of twenty-four hours this should be followed by a blister three or four inches square if there is much præcordial distress, anxiety, and palpitation; or, if the patient is vigorous, a dozen leeches may be applied. On the other hand, if the cold application has had the effect of allaying cardiac excitement, it may be replaced by a belladonna plaster. The latter possesses one marked advantage over the blister in that it does not interfere with the renewed application of the ice-bag, which may be laid directly upon it.

Both calomel and iodide of potassium are drugs to which tradition, presumably based upon experience, assigns the power of promoting

absorption of inflammatory exudates. The former may be given from the commencement of the attack, and if it has no other effect than keeping the bowels active it will not be employed in vain. When the temperature has become normal and the heart has lost its irritability—in other words, when the inflammation has apparently run its course—iodide of potassium may be prescribed, beginning with 5 grains three or four times daily and gradually increasing the dose until 30 or 40 grains are taken *per diem*. This drug should be continued, with occasional intermissions, for two or three months. It may be conveniently administered in saturated solution (one drop containing one grain) mixed with milk, the unpleasant taste of the drug being most effectually disguised by this fluid.

TREATMENT OF THE RESULTS OF VALVULAR DISEASE.—Although it cannot be too strongly emphasized that each case of valvular heart disease should be treated individually—*i. e.* with special reference to the indications it presents—there are certain general hygienic regulations that are applicable to all cases. The chief of these have reference to diet, clothing, occupation, dwelling, the use of tobacco, marriage, bathing, etc.

Diet.—In describing the symptoms common to cardiac valvular disease the marked tendency to digestive disorders was pointed out. The food should therefore be of the most digestible character and the amount consumed at any single meal should be restricted. It is decidedly better to add to the number of the daily repasts than to overload the stomach at any one of them. The uncomfortable sense of repletion, the cardiac oppression, and sometimes the palpitation experienced by healthy people after a surfeit are significant indications of the dangers attendant upon similar indiscretions by those affected with heart disease. A diet largely composed of carbohydrates is, in my experience, the one best suited to the cases under consideration, and especially is this the case during the stage of hypersystole.

Tender meats, boiled, broiled, or roasted, light puddings, such as may be made of rice, bread, tapioca, and Irish moss; fruits, either fresh or stewed, and all kinds of succulent vegetables are admissible; while rich soups, pastry, fried meats, and fat should be eschewed. Butcher's meat should not be a constituent of more than two of the daily meals, and as a rule the patient will thrive best when it is consumed but once daily, its place being amply supplied at the other repasts by eggs, fish, excluding salmon, and milk. At times, when signs of indigestion appear, the diet may for a few days be advantageously restricted to milk with the addition of bread or other farinaceous substance. It is well established that the digestion of milk is accomplished with a minimum degree of labor on the part of the digestive organs, and after the comparative rest which they enjoy on

a milk diet their functions are performed with greater efficiency. It has been estimated that at least three litres of milk are necessary to maintain the nutritive equilibrium of an adult at rest, as is evident from the following tables:

1. *Amount of nutriment required by an adult at rest:*

Water,	2635 grammes;
Albumin,	137 "
Fat,	117 "
Carbohydrates,	352 "

2. *Constituents of 3 litres of milk:*

Water,	2593 grammes;
Albumin and casein,	108.80 "
Butter,	121.50 "
Sugar,	165 "

Since few stomachs can tolerate the daily ingestion of three litres of milk, it will be found best, as a rule, to restrict the amount of this substance to two litres and supplement the deficiencies with bread and butter. There are certain individuals who cannot or will not tolerate milk either in the crude state or peptonized or boiled, and of such it can only be said that they are placed at a disadvantage for which there is no compensation.

Of late years a most commendable industry has been displayed by the manufacturers of alimentary substances; so much so, in fact, as to have excited hopes in the minds of visionaries that the definition of man as a cooking animal will ere long cease to be appropriate. Certain of these food-products are of undoubted value in cases of heart disease, and may be administered either as complementary to a partial milk diet or as additions to a restricted solid dietary. Those which I have in mind belong chiefly to the proteid group, and are either fully or partially prediges ted. I refrain from specific mention of any of these substances for reasons that are, doubtless, well understood, leaving to the intelligent practitioner the duty of determining their value in individual cases.

Clothing.—The clothing should be warm, light, and loose. That next the skin should be of wool throughout the year. Many patients, especially women, will object to such a requirement, as they will to the equally important advice to discard the thorax-constricting corset. The demands of fashion are, in their case, more imperative than those of hygiene, and, since the physician cannot compel obedience, he is often obliged to make concessions which are unnecessary in the case of men. It is above all things important that the feet should be kept

warm and dry. I have seen the most marked cardiac incompetence, with universal anasarca, suddenly arise after prolonged immersion of the feet in cold water, the patient having previously exhibited no signs of cardiac failure. There is, in all cases of valvular disease, and more especially in the mitral lesions, a congested condition of the bronchial mucous membrane which may be regarded as the point of least resistance. An aggravation of this congestion by the supervention of bronchial catarrh is often sufficient to convert a condition of comparative well-being—"eusystole"—into one of pronounced "hyposystole." Every means, therefore, should be adopted to avoid "catching cold," and, of them, those which relate to the clothing are the most important. The practice of wearing light slippers in-doors is a fruitful source of colds and should be condemned. In the best-ventilated houses it is impossible to maintain the temperature of a room at a uniform level, and therefore the feet are constantly surrounded with a comparatively cold stratum of air. The inference is that it is more important to secure warmth of the feet while in-doors and at rest than while out of doors and walking.

Occupation and Exercise.—Occupations which involve either intermittent or long-continued muscular exercise, as well as those which, although sedentary, require a cramped position of the body, and so interfere with respiration, are inadvisable. Under the latter head come the trades of tailoring and shoemaking. It is an excellent rule to warn the patient against the pursuit of such occupations as, in the healthy, tend to develop the muscular system. The type of such trades is that of the blacksmith, and practically on the same plane is the work of the sailor, the carpenter, and the boiler-maker. In my experience, a large proportion of cases of heart disease, especially of the aortic valves, have come to hospital from machine shops in which the patient, while engaged in severe manual work, has been exposed to sudden and great changes of temperature.

It is useless to prescribe a serene frame of mind to individuals of excitable temperament, but they should be advised to desist from pursuits which tax the emotions severely. Outbreaks of temper and violent emotions generally act in the same way as severe bodily exertion. In this connection the most interesting case on record to medical men is that of John Hunter, who had long suffered from angina pectoris and died from the immediate effects of violent excitement. The scene of his death was the board-room at St. George's Hospital. "In the course of his remarks he made some observation which one of his colleagues thought it necessary instantly and flatly to contradict. Hunter immediately ceased speaking, retired from the table, and, struggling to suppress the tumult of his passion, hurried into the adjoining room, which he had scarcely reached when, with a deep

groan, he fell lifeless into the arms of Dr. Robertson, one of the physicians of the hospital who chanced to be present." [1]

Hunter, from all accounts, was a man of ungovernable temper and quite conscious of his infirmity, for before the meeting referred to he had "expressed his apprehension lest some unpleasant dispute might occur, and his conviction that, if it did, it would certainly prove fatal to him."

In all such counsel as relates to the occupation, the circumstances of the patient are first to be considered. Advice which, to the affluent, is easily followed and perhaps coincides with his inclinations, is impossible and absurd to him whose daily bread is obtained by the keenest competition. Who can deny that the latter has chosen the better part when he decides to die at his post? Certainly not the physician whose example is so often in direct contrast to the precepts which he endeavors to inculcate.

As long as there is perfect compensation for a valvular defect the patient is conscious of no cardiac imperfection. It is a great mistake, however, to encourage such a person to compete, whether in the way of business or amusement, with individuals in perfect condition—*i. e.* if such attempts are attended with physical exertion.

The inevitable medical tendency to pass from one extreme to another is nowhere more marked than in the treatment of heart disease. It is not long since the belief was prevalent that valvular heart disease doomed the patient to speedy death, in spite of the fact that the individual in whose case the diagnosis was made, perhaps by mere accident, was conscious of no cardiac trouble. Such opinions were definitely refuted by Sir Andrew Clark, who reported 684 cases of valvular disease which had been in existence for at least five years without leading to any serious impairment of health. A complete reaction from the old pessimistic views at once set in, and instead of immuring such patients in their homes and condemning them to a life of inactivity, they are now often encouraged to exert themselves to the utmost of their limited capacities. In my opinion, the present tendency is rather to encourage patients with heart disease to overexertion. They are not sound, vigorous individuals, and although they should, as far as possible, refrain from brooding over their ailment, they should also never completely forget its existence. The only exercise in which they should indulge to any great extent is walking. Any exertion which involves much use of the arms, such as rowing, is injurious, and tennis, base-ball, cricket, bicycling and swimming are suicidal. Probably the most injurious combination of sports is swimming in cold water.

The Oertel method, which combines a special dietary with massage,

[1] *Hunterian Oration for 1855*, by Joseph Ridge, M. D.

vapor- and hot-air baths, and carefully graduated exercise in the open air, will be described in detail when discussing the treatment of fatty infiltration of the heart. It is undoubtedly advantageous in certain cases of well-compensated valvular disease in which there is a decided tendency to obesity, but is contraindicated by extensive arteriosclerosis, angina pectoris, and failing compensation—in a word, by hyposystole.

The use of tobacco should be absolutely interdicted. No healthy person addicted to the use of tobacco who is self-observant can have failed to notice that it excites the action of the heart, whether by stimulating one set of nerves or depressing another it is not our province to inquire. The effect of the weed is necessarily more powerful upon a heart already weakened by disease. As a rule, the patient experiences no great difficulty in weaning himself from tobacco. In fact, he often does so voluntarily, finding that its fumes, which were formerly so agreeable, have either lost their soothing power or become positively distasteful.

Tea and coffee in moderation—one cup of either twice daily—may be permitted, the caffeine which they contain being generally acknowledged to be one of the most valuable drugs employed in the treatment of heart disease.

Schott Treatment of Chronic Heart Disease.—The method of Dr. Schott, as pursued by him at Nauheim, has of late received considerable attention, although it has been in successful operation for many years.

The method is a twofold one, consisting chiefly in the use of saline baths highly charged with carbonic acid gas, and of carefully graduated, gentle exercises. The springs of Nauheim contain an extraordinary amount of carbonic acid gas (1.340 c.cm. to the litre) and are remarkably rich in mineral constituents, of which the chief are chloride of sodium, chloride of calcium, and carbonate of iron. The first-mentioned salt is in solution to the amount of from 2 to 3 per cent.; the two latter, to the amount of from 2 to 3 per mille. In the opinion of thoroughly competent and trustworthy men who have investigated Schott's method, these baths exert a remarkable effect upon the circulation and consequently upon the heart.[1] On immersion, the bather experiences a sensation of tingling and warmth which is due to the contact of the particles of carbonic acid gas with the integument. The pulse becomes slower and increases in volume and strength, while the area of cardiac dulness, in cases of dilatation, perceptibly diminishes and the apex-beat approaches more closely to the normal position. The liver also, when engorged in consequence of incompetence of the right ventricle, becomes demonstrably smaller.

[1] *Cf.* J. F. H. Broadbent and Sir William Broadbent, *Practitioner*, May, 1895.

In the employment of this powerful therapeutic agent certain precautions are essential. The patient should not at first be bathed in the unmitigated Nauheim water. Schott advises at the beginning of treatment a bath containing 1 per cent. of chloride of sodium and 1 per 1000 of chloride of calcium, and free from carbonic acid gas. The gas is liberated by causing the water, as it issues from the spring, to gush up in the form of a fountain, the carbonate of iron being oxidized in the process. The water after this treatment is of a reddish-brown color, this tint being imparted to it by the oxide of iron. The temperature of the early baths should range from 92° to 95° F., and the patient should be immersed from six to eight minutes.

Dr. Bezly Thorne,[1] in order to determine whether the virtues of the Nauheim waters are dependent upon their mineral ingredients, performed the following auto-experiment: He immersed himself for the space of ten minutes in three different kinds of water, namely, (1) the ordinary water of London; (2) the waters of Llangammarch Wells in Breconshire, (3) the water of the Nauheim spring No. 7. The composition of London water is certainly not such as to entitle it to the term "mineral," while that of Llangammarch Wells contains 2.7 of chloride of sodium, 1.2 of chloride of calcium, and 0.09 of chloride of barium per 1000, and the water of the Nauheim spring in question contains about 22 parts of chloride of sodium and about 1.7 of chloride of calcium per 1000. In order to test the effect of the mineral ingredients alone the Nauheim water was freed from the carbonic acid which it naturally contains in such large amount. The temperature of the water in these experiments was 90° F. The immediate effect upon the pulse, in each instance, was a diminution of frequency proportional to the rate before immersion and a marked increase in volume, but here the resemblance ceases. In the plain water there was a sense of coldness during the last two or three minutes which was only removed by brisk towelling, while in the saline baths there was continuously a glow of warmth and a sense of well-being. The contrast afterward was still more marked, for the feeling of exhilaration and vigor produced by the saline baths was entirely absent after immersion in ordinary water. As the result of his experiments, Thorne believes it "correct to say that, in respect of therapeutic influence on a disabled heart and an impaired circulation, fresh-water baths may be dismissed from consideration."

During the first few minutes of immersion in the Nauheim water there is often a sense of oppression in the epigastrium attended with labored breathing, coincidently with which the area of cardiac dulness undergoes a diminution in its oblique transverse diameter to the extent of one-third to one-half inch in the healthy, while in those with

[1] *British Medical Journal*, March 9, 1895.

dilated heart it may amount to one inch or more. The liver also, if enlarged, may be observed to undergo a marked diminution in size. As a result of the improved tonicity of heart and arteries the bath is followed by free diuresis which often sets in on the first day of treatment and may continue throughout its course.

The other portion of the Schott method is a species of gymnastic exercise which is aptly characterized by the German term *Widerstand-gymnastik,* and consists of a series of movements of the upper and lower extremities and the trunk which are gently resisted by a carefully trained assistant. These movements are of the simplest description, and need not be described in detail, since it is highly probable that any movements of flexion and extension of the extremities and rotation of the trunk which call into play the principal muscles of the body will accomplish precisely similar results. Gentle resistance to these movements undoubtedly adds to their efficacy.

The effect of these exercises, which, be it remembered, are of a very gentle character, is very similar to that of the baths, although they do not reduce the frequency of the pulse in so marked a degree. The baths also are believed to exert a more profound influence on the nutrition of the tissues of the heart and blood-vessels and on those of the system in general. Be that as it may, the combined effect of the baths and exercises is, in the opinion of Thorne, such as to "throw the action of drugs completely into the shade."

Mode of Action of the Baths and Exercises.—The effects produced by the baths are thus accounted for by Thorne: It is well known that there is less blood in the body than can fill the entire vascular system at the same time and that the vessels of the muscular system can expand to such an extent as to "allow the arterial blood to pass through them alone as quickly as it usually does through the vessels of the skin, intestines, and muscles together." The effect of immersion in a bath of which the temperature is from 3° to 10° F. lower than that of the body is to contract the cutaneous vessels and determine the blood to the muscles, the vessels of which become greatly dilated. The effect of such dilatation is not only to diminish peripheral vascular resistance and, consequently, to ease the heart, but also to increase oxidation, calorification, and metabolism in an enormous vascular district—that of the muscles. At the same time the mineral ingredients and carbonic acid contained in the bath-water stimulate the cutaneous nerves, prevent chill, and favor reaction, so that, after the bath, the vessels of the skin as well as those of the muscles are dilated. The gentle muscular exercises act in precisely the same manner—*i. e.* by promoting vascular dilatation in the muscular system. The blood, by this combined method, is transferred from the veins where it has been a "vehicle and a store of poisonous ingredients,

to the arteries in which it flows a purified and oxidizing steam." At the same time the vascular capacity is so increased as to "afford to a laboring heart the relief which would arise from free venesection without despoiling the system of one drop of blood. Accumulation of blood in the heart and veins tends to death; transfer of the excess to the arteries and capillaries is life."

The foregoing remarks concerning the effect of the Schott method upon the distribution of the blood must not be regarded as plausible deductions derived from its manifest operation in easing the heart and relieving the signs and symptoms of passive congestion. On the contrary, the Schott method is based upon well-known physiological laws, the knowledge of which must be taken for granted.

The effect of this mode of treatment in relieving the numerous symptoms dependent upon venous stasis is often remarkable. The engorgement of the gastric and intestinal vessels being relieved, digestion improves and appetite returns. The breathing becomes freer. The condition of the blood improves in a striking manner, as shown most conspicuously by a return of healthy color to lips and cheeks; and œdema, ascites, and hydrothorax, if present, diminish or disappear entirely. The effect upon the mind is still more striking, despondency and gloom being replaced by cheerfulness and hope.

The Schott system does not restrict the amount of water ingested. On the contrary, it encourages its free imbibition, on the ground that the blood of those who have been long suffering from venous stasis is a reservoir of uric acid and other excrementitious substances which, if not speedily eliminated through the medium of the ingested water, are, at least, deprived of a portion of their toxicity by dilution. Nitrogenous food is also freely permitted, and an abundance of succulent vegetables, while the carbohydrates are allowed more sparingly on the ground that they tend to the formation of acids and fat—still, as regards diet, each case must be separately studied, for, in the opinion of the writer, many cases of cardiac valvular disease progress more favorably upon a diet in which nitrogenous food is reduced to a minimum.

Artificial Preparation of the Baths.—Patients who are unable to visit Nauheim are not necessarily debarred from the employment of the Schott method of treatment. In fact Dr. Schott himself has given directions by which an artificial Nauheim bath may be prepared by any one. Mr. William Armstrong of Buxton[1] has employed the artificial Nauheim bath in his own practice in cases of advanced cardiac disease with failing compensation, and states that the results thereby obtained have far exceeded his expectations. The proportions of solids in the successive baths are carefully graduated,

[1] *Liverpool Medico-Chirurgical Journal*, vol. xv., 1895, p. 491.

the patient beginning with a comparatively weak solution of salts, to which later in the course of treatment, carbonic acid gas is added.

The following directions for the preparation of the baths are given by Armstrong, it being understood that the amount of water in each bath is 40 gallons:

Bath No. 1: Sodium chloride, 4 lb.; calcium chloride, 6 oz.
" " 2: " " 5 "; " " 8 "
" " 3: " " 6 "; " " 10 "
Sodium bicarb., 8 oz.; acid. hydrochlor., 12 oz.
" " 4: Sodium chloride, 7 lb.; calcium chloride, 10 oz.
Sodium bicarb., 8 oz.; acid. hydrochlor., 12 oz.
" " 5: Sodium chloride, 9 lb.; calcium chloride, 11 oz.
Sodium bicarb., 1 lb.; acid. hydrochlor., $1\frac{1}{2}$ lb.
" " 6: Sodium chloride, 9 lb.; calcium chloride, 12 oz.
Sodium bicarb., $1\frac{1}{2}$ lb.; acid. hydrochlor., $2\frac{1}{2}$ lb.

The maximum strength is reached at the sixth bath, but it does not necessarily follow that bath No. 6 is taken on the sixth day of treatment. The strength of the baths is increased in accordance with their effects upon the condition of the patient.

The only diseases in which the baths are either contraindicated or to be employed with the greatest circumspection, are aneurism and angina pectoris, the genuine angina of Heberden.

I have dwelt at some length upon the Schott method, first, because it fulfils in the completest possible manner the indications furnished by the conditions of the circulation in cases of failing cardiac compensation; and, secondly, because, while it has been endorsed by many of the leading physicians of Europe, it has, thus far, received little or no attention in this country. At the present day there is little or no difficulty in introducing a new drug into the best society—the *ipse dixit* of an enterprising manufacturer is all-sufficient for that purpose. The case, however, is very different with a *system* of treatment, whether dietetic or hygienic, even though it be based upon universally acknowledged laws of physiology or hygiene. For a time, which is usually protracted, the latter has to maintain a struggle for existence, but in the end it is bound to survive.

Medicinal Treatment of Valvular Heart Disease.—By a careful regulation of the diet, the occupation, the amusements and sports, the hours of sleep and the functions of the digestive organs—in short, by the observance of the laws of hygiene, the necessity for employing drugs addressed directly to the heart and blood-vessels—the cardio-vascular tonics—may, in many cases, be almost indefinitely postponed. Sooner or later, however, in the majority, the time arrives when such remedies are imperatively needed, and of them all, digitalis is still universally acknowledged to be *facile princeps*. While I can-

not entirely coincide with Huchard's statement that without digitalis there would be no cardiac therapeutics,[1] I am convinced that all the other tonics are, at best, but succedanea to that invaluable drug. It would be out of place to discuss the question of the *modus operandi* of digitalis, especially as it is still unsettled. It is enough for the clinician to know that under its influence the ventricular contractions become stronger, slower, and more regular, and that the tonicity—the tension—of the arteries is increased. There is a certain physiological antagonism between the arterial and venous systems, the maintenance of which is essential to a perfect circulation. The tendency of every variety of valvular heart disease is to destroy this antagonism, and the object of treatment is to restore it. Failing compensation is synonymous with exhaustion of the heart and arteries. The tension of the latter becomes relaxed, they are ready to abandon the struggle, and the entire circulation approaches a venous type. The latter fact is further indicated by a scanty secretion of urine, by œdema, and often also by a subnormal temperature. The object of treatment, under these circumstances, is to strengthen the heart and at the same time to increase the arterial tension, and this may be most successfully accomplished by digitalis. There are certain facts concerning this drug and its indications which need to be set forth in some detail.

The first requisite to the successful employment of digitalis is the presence of more or less healthy muscular fibre in the heart, for it can no more act in the absence of muscular fibre than can electricity traverse a divided nerve. Is there any method by which we can judge of the degree to which degeneration of cardiac muscular fibre has advanced? We are justified in inferring the presence of considerable healthy muscular fibre if the first sound is, as in health, louder, deeper toned, and more prolonged than the second, and if the apex-beat, instead of being diffuse and faint, is sharply defined and plainly palpable. Again, a distinct murmur can only be produced by a heart acting with considerable force, so that a faint murmur coinciding with signs of failing compensation is of more serious import than a distinct one. The response to appropriate treatment is, however, the best of all tests of the condition of the cardiac muscle.

Another indication for the employment of digitalis is weakness and irregularity of the pulse. Wihering, who wrote a treatise on digitalis toward the close of the last century, and who probably did more than any one else to bring the drug into judicious use, had the sagacity to perceive that it is much more efficacious when the pulse is feeble and intermittent than when it is hard and regular. Although the phrases "high and low arterial tension" were not then invented, the treatment of this keen observer was just as skilful as though they were.

[1] "La thérapie cardiaque serait impossible sans la digitale."

The next question we have to consider is whether the success which follows the use of digitalis is due to the nature of the lesion; *i. e.* whether the indications for the employment of this drug depend upon the valve affected and the nature of the circulatory disturbance to which it gives rise. The question has given rise to a great deal of profitless discussion, owing to the fact that most observers have approached their cases of heart disease with preconceived opinions derived from authoritative teachers. For example, Grisolle, one of the most distinguished physicians of his time, declared digitalis to be not only useless but injurious in all such valvular lesions as give rise to stenosis. In 1867 Lelion,[1] in his inaugural thesis, expresses an opinion exactly the reverse, for he says that digitalis is indicated in stenosis of the valvular orifices; contraindicated in those which give rise to insufficiency.

In 1877 Milner Fothergill adopts the same view, so far as aortic stenosis is concerned. Digitalis, says Fothergill,[2] is "useful in aortic stenosis. By exciting a more powerful ventricular contraction it enables a larger amount of blood to be driven through a narrowed orifice in an equal time, thus establishing a new equilibrium."

Niemeyer, on the other hand, held that digitalis was, as a rule, contraindicated in aortic stenosis, and advised that, in this form of heart lesion, it should only be employed in cases in which compensation is failing or the action of the heart is so rapid as to prevent the proper discharge of the contents of the left ventricle.

The same differences of opinion have prevailed with reference to the use of digitalis in lesions of the mitral orifice. Niemeyer advised its use in mitral stenosis, on the ground that by slowing the action of the heart it gave the left auricle more time in which to discharge its contents into the left ventricle. On the other hand, Potain maintained that it was in just these cases of mitral stenosis that digitalis could be most easily dispensed with.

Gubler, a well-known French authority, held that both in mitral insufficiency and stenosis, little benefit was to be derived from digitalis.[3]

These are but a tithe of the contradictory statements with reference to the best cardiac tonic in the Pharmacopœia. Can they be reconciled, and, if so, in what manner? Certainly not by endeavoring to impeach the testimony of the distinguished men I have quoted. They are all partly right and, therefore, none of them entirely wrong. The cause of their discrepant statements concerning the action of digitalis is to be found in the stage of the disease in which they employed it. In the same case of valvular heart disease, digitalis may

[1] Quoted by Huchard. [2] *British Medical Journal*, Oct. 13, 1877.

[3] *Cf.* Huchard: "Quand et comment doit-on prescrire la digitale?"

be found decidedly injurious in one stage, useless in another, and decidedly beneficial in the third.

With reference to the action of digitalis, cardiac valvular disease has been divided into three stages: 1. Eusystole; 2. Hypersystole; 3. Hyposystole. In the first, compensation is fully made for the valvular defect. There is no dyspnœa except on decided exertion, no palpitation, no cough, no œdema, or any other sign of venous stasis. Under such circumstances, digitalis is not indicated; it is absolutely useless, and might be injurious. The only treatment to be advised is of a strictly hygienic nature.

At a later stage of the same case the symptoms may have undergone a very decided change. The heart has enlarged; there is a tendency to active congestion, manifested by fulness of the head, cephalagia, tinnitus aurium, vertigo, and insomnia. The impulse of the heart is powerful and outside of and below its normal situation, while the pulse is full and resistant. Under such circumstances as these, digitalis is decidedly injurious, and since this stage is more pronounced in cases of aortic valvular disease, especially aortic regurgitation, the hasty inference has been made that digitalis is injurious in all cases and stages of aortic lesion. The bromides, morphine, and aconite are the drugs for this stage of valvular disease, but the most important rôle is still to be assigned to hygiene. Rest in bed, and a bland diet of which the only animal ingredients are milk and eggs, should be prescribed, and a rigid abstinence from alcoholic liquors, tea, coffee, and tobacco enforced. The stage just described is that of hypersystole.

The stage of hyposystole may be said to begin when there is dyspnœa on slight exertion or even in ordinary conversation, œdema about the ankles, at first only observed at night on retiring, and a scanty secretion of urine. There will also be failure of appetite and other signs of digestive disturbance due to disordered circulation of the gastro-intestinal tract. These symptoms coincide with diminished arterial tension; perhaps also with feebleness, irregularity, and intermittence of the pulse. It is in this stage of heart disease that digitalis is employed with most brilliant results; and as this stage may be reached in any case of heart disease, irrespective of the valve affected, it follows that the true indications for the drug are to be found rather in the symptoms of cardiac affections than in their physical signs.

It is undoubtedly the case that certain valvular affections are, as a rule, more benign in their course than others, and may last for years without giving rise to any decided symptoms, the patient finally dying of some intercurrent affection. The indications for digitalis, in such cases, may never arise unless exposure to cold and wet or other depressing causes induce a state of acute cardiac insufficiency.

The facts above mentioned afford the only satisfactory explanation of the discrepant statements with reference to the employment of digitalis in heart disease.

I trust I have made it plain that the indications for digitalis are to be found only in the functional capacity of the cardiac muscle. When it is working regularly and overcoming the valvular obstruction without exhausting the reserve force inherent in every heart, digitalis is useless and may be injurious. When the heart is excited in its action—that is, when it is making superfluous efforts to overcome the obstruction, provided this coincides with increased arterial tension, digitalis is decidedly injurious. When the arterial tension is low, and the whole circulation is approaching a venous type, digitalis is decidedly beneficial. These statements apply to all cases of heart disease, irrespective of the particular valve or valves involved.

On prescribing digitalis in a given case and obtaining no immediate results, it should not be hastily concluded that the drug is useless. Although the fact has been denied, there can be no doubt that its action is cumulative, and, therefore, sometimes not manifest until it has been continuously administered for two or three days. Its effect also persists for several days after its withdrawal. On these accounts, Huchard has formulated the law that digitalis should be prescribed in progressively diminishing doses.

There are certain effects of digitalis which are often attributed by the inexperienced to the disease for which it is prescribed. For example, while slowing and strengthening the pulse, it often makes it very unstable—so much so that the least excitement may cause it to increase in frequency at the rate of from twenty to thirty beats per minute. The same result is produced by slight muscular exertion, such as turning over in bed. For these reasons the best results from digitalis are obtained by keeping the patient at rest while he is taking it. When the circulatory equilibrium is thoroughly restored by the use of the drug, the patient may be allowed to rise and take a proper amount and kind of exercise.

In valvular disease, where the patient is taking digitalis, the physician should occasionally compare the number of the pulse-beats with those of the heart. Cases are occasionally encountered in which the number of heart-beats is greater than that of the pulsations of the radial artery. This is due to the fact that some of the heart-beats are abortive or, if not entirely so, are too weak to occasion a palpable pulse at the wrist. The number of the cardiac pulsations may be exactly double those of the radial artery, and, in the opinion of some authorities, this is due to an asynchronous contraction of the two sides of the heart. I have published a case in which this condition seemed to

exist.[1] The possibility of the independent action of the right and left ventricles has been denied, and when we consider the manner in which the spiral, circular, and other muscular fibres pass from one ventricle to another without any tendinous septa or other lines of demarcation between them, it is difficult to understand how this can occur; in the case to which I refer, however, the sphygmograph recorded two beats of the heart to one of the radial pulse, and the relation of the curves representing the double heart-beats was, in point of volume, just what would be expected from the relative strength of the two ventricles.

I mention these peculiarities of cardiac action because they have been attributed to the action of digitalis. The question whether or not they are due to the drug is, I believe, an open one. There is one form of cardiac action which is generally acknowledged to be due to digitalis. It is a species of regular irregularity manifested by what has been called the "pulsus bigeminus," *i. e.* there are two rapid beats of the heart separated by a long interval, and this may continue for hours.[2]

Modes of Administering Digitalis.—The physician, in prescribing digitalis, should convince himself, as far as it is possible for him to do so, that the preparation he is employing is an active one. Nothing, in my experience, has impressed me more than the marvellous effect of digitalis in cases of cardiac incompetence, and when it fails I at once suspect either that there is something faulty in the preparation of the drug or that it has not been absorbed. In some cases the latter surmise is correct, and, therefore, before condemning the drug we should employ the means at our command to promote its absorption. In many cases in which the veins are clogged, the viscera congested, and the lymph-spaces and serous cavities distended with fluid, the administration of digitalis may advantageously be preceded by energetic purgation with a concentrated solution of magnesium sulphate or other saline, or even by venesection. The latter, in my experience, is rarely necessary. I have, in apparently desperate cases, obtained results which left nothing to be desired, by the simultaneous administration of digitalis and saline purgatives.

The preparations of digitalis commonly employed are the infusion, tincture, powder, and fluid extract. The infusion, which many clinicians regard as the most effective preparation, may be given in doses of half an ounce every six hours, or even more frequently, until the pulse is reduced in frequency and made tenser, when it should be discontinued, or administered at longer intervals or in smaller doses.

[1] *Archives of Medicine*, Aug., 1881.

[2] See "Digitalis in Valvular Disease of the Heart," by F. P. Henry, M. D., *Medical and Surgical Reporter*, Nov. 22, 1890.

The disadvantages of the infusion are its bulk and its taste, which to many patients is somewhat nauseating. On these accounts many prefer the tincture, which is also regarded by some authorities as possessing a more powerful diuretic action. I cannot agree with the latter opinion, believing the diuretic action of digitalis to be a secondary phenomenon dependent entirely upon its action upon the heart and blood-vessels. An advantage of the tincture is that it is more apt to be of uniform strength than the infusion. The latter should be freshly made from the leaves for each prescription, and therefore variations in the amount and quality of the active ingredients may, for manifest reasons, occur. It is impossible to formulate any fixed rules with reference to the dosage of the tincture, but at the beginning of treatment of an urgent case it is usually safe to administer 15 minims every three hours until 2 drachms have been taken. The dose should then be reduced to 10 minims at the same intervals or to 15 minims three times a day. It may be continued almost indefinitely in doses of 10 minims twice or thrice daily, always, be it understood, under the supervision of the physician.

The powder is a very effective preparation. Sansom considers the tincture the most reliable of the preparations of digitalis and the powder the second in rank. If I were to judge solely from my own experience I would place the powder first. I could relate the histories of several cases in which the patients were rescued from impending death by the use of 1-grain doses of the powder, in combination with purgatives and diuretics. One such case I recently saw in consultation with Dr. Haydon, the patient being a man about sixty years of age, whose legs, scrotum, and peritoneal cavity were distended with serous effusion, and whose general condition was most pitiable. The preparation of digitalis recommended by me was the powder, and none other was given. In the course of three or four weeks this man, whom we had fully expected to die, was able to walk from his house to Fairmount Park—a distance of at least a quarter of a mile.

It is not unlikely that the excellent results so often obtained from the powder are in part due to the fact that it is almost invariably given in combination with other substances and especially with diuretics and diaphoretics. A favorite prescription of my own, and, in fact, the one employed in the above-mentioned case, is the following:

℞. Pulv. digitalis, ℈j (1.3);
Potass. nitratis, ʒj (4.0);
Pulv. ipecac. et opii, ℈j (1.3).
M. et div. in chart No. xx.
Sig. One powder every three hours.

Powdered squill may be substituted for the nitrate of potash, and may sometimes be found more effective as a diuretic; or a purgative may be substituted or added. The combination of 1 grain each of powdered digitalis, powdered squill, and calomel, is a time-honored one and undoubtedly one of the best, but I think it is a mistake to administer it in pill form, as is often done. The powder is much more readily absorbed. Sometimes an active cathartic effect, in combination with that of digitalis, is desirable, in which case from 1 to 2 grains of powdered scammony may be added to each powder, as in the following prescription:

℞. Pulv. digitalis,
Pulv. scillæ, āā. ℈j (1.3);
Pulv. scammonii, ℈ij (2.6).
M. et div. in chart No. xx.
Sig. One powder three times a day.

The compound extract of colocynth, in similar doses, may be substituted for the scammony in the last prescription, in case of the failure of the latter to purge efficiently.

An active condition of the bowels is not only, in itself, beneficial in most cases of hyposystole, but is also conducive to the favorable action of digitalis, and it is my usual custom to direct the patient, while taking the latter drug, to take also every morning, or every second morning, a saline cathartic. The dose of the cathartic need not be large. What we wish to obtain is a daily watery evacuation, and this may, in most cases, be secured by the use of a drachm or two of magnesium sulphate in a glass of water before breakfast. The patient may be directed to dissolve one ounce of Epsom salts and half an ounce of cream of tartar in a pint of hot water and set it aside in a bottle. Of this solution he may take four ounces every morning on an empty stomach. My best results in the treatment of valvular heart disease in advanced stages have been obtained by some such simple saline mixture in combination with digitalis, and especially with the powder in one or other of the above-mentioned combinations.

Under the head of *digitaline* is included a number of substances extracted from digitalis, which may be divided into two groups: 1. Substances soluble in chloroform and insoluble in water—crystallized digitaline, amorphous digitaline, and digitoxin. 2. Substances insoluble in chloroform and soluble in water—digitaleine and German digitaline. According to Fouquet and Barié[1] the substances of the first group possess, when pure, the same degree of activity as, and are to be preferred to, those of the second group.

[1] *Thérapeutique des Maladies du Cœur*, Paris, 1894.

There are great differences of opinion concerning the virtues of these various so-called alkaloids, but in the writer's judgment digitoxin is the most uniform as to chemical composition and therapeutic activity.

Nativelle's crystallized digitaline, which is strongly recommended by Balfour, is probably largely composed of digitoxin. Writing in 1876 [1] he endorses it, and nearly twenty years later,[2] he states that it "is now and always has been a thoroughly reliable and active drug." Each granule contains $\frac{1}{4}$ milligramme of "digitaline"—equivalent to about $\frac{1}{260}$ grain—and is equal in strength to ten minims of the tincture and one grain of the powdered leaves. It can be administered both *per os* and hypodermically, and is of special service in the latter form in cases of intense gastro-intestinal congestion where absorption takes place with great difficulty. The hypodermic administration of this preparation, or, in fact, of any active preparation of digitaline is necessarily painful, owing to the fact that the drug is insoluble in water, this being a *sine quâ non* of activity. It is, however, readily soluble in dilute alcohol.

The above estimate of the strength of Nativelle's digitaline, which is given on the authority of Balfour, is probably incorrect, for the same author states that if more than two of the granules are given by the mouth in one day, nausea and vomiting are apt to ensue. Certainly, no physician could hope for any marked results from two grains of the powdered leaves, or twenty minims of the tincture of digitalis, which, according to Balfour, are the equivalents of two of Nativelle's granules.

Substitutes for Digitalis.—Although authorities may differ as to the relative merits of the various preparations of digitalis, they are all practically united in the belief that nothing can completely take its place. Of the numerous succedanea for digitalis the chief are strophanthus, convallaria, sparteine, caffeine, casca, adonidine, arsenic, and the chloride of barium. For most of our knowledge of the first mentioned, which is undoubtedly the best, we are indebted to the admirable researches of Professor Fraser of Edinburgh.

The wide differences of opinion that have prevailed and are still current concerning the action of *strophanthus*, render the conclusion inevitable that this drug is a more uncertain and less powerful heart tonic than digitalis. Out of 120 cases Fürbringer obtained favorable results in but 30, and these were mostly cases of dilatation without valvular lesion. Very similar results were obtained by Fränkel. On the other hand, Bucquoy regards strophanthus as a cardiac tonic of the first rank, even superior in some respects to digitalis; for, while it strengthens the heart and promotes diuresis, it is non-cumu-

[1] *Clinical Lectures on Diseases of the Heart and Aorta.* [2] *The Senile Heart*, 1894.

lative and does not give rise to nausea. The only symptom of intolerance observed by Bucquoy was a painless diarrhœa which is often beneficial. According to the United States Dispensatory (17th edition) it is probably superior to digitalis as a diuretic, exerting its action not only indirectly through rise of blood-pressure, but also directly through its supposed action upon the secreting cells of the kidney.

From clinical observation, I am convinced that strophanthus increases decidedly the force of the cardiac contractions and lessens their frequency, but I cannot coincide with the view that it is a more powerful diuretic than digitalis. Probably, the best method of employing strophanthus is to perpetuate the effect initiated by digitalis. For example, after five or six days' use of the latter, strophanthus may be prescribed, and in virtue of its non-cumulative action may be continued as long as the patient's condition is favorable. At any time when the heart shows signs of flagging, digitalis should be resumed. A tincture of strophanthus of the strength of 1 : 20 has been added to the last edition of the U. S. P., and should be given, at first, in doses not exceeding 5 minims. The glucoside strophanthin has been isolated, but has been too little employed by clinicians to warrant its recommendation.

Sparteine is most commonly employed in the form of the sulphate, which may be given either in pill or solution in doses of one-fourth to one-half grain. The late Dr. Edward T. Bruen of Philadelphia found this salt to possess considerable diuretic power in "intractable dropsy due to heart-failure, caused by the dilatation secondarily following hypertrophy." He believed also that it increased the strength of the heart's action and reduced its frequency. He, however, found it to induce a sensation of numbness in the lower extremities, and in one case paralysis—symptoms which, he says, might be expected from its physiological action. He believed also that sparteine exerted cumulative effects, and advised caution in administering larger doses than one-fourth grain three times a day.[1] I have used sparteine sulphate with what seemed to me good results in cases of slight cardiac incompetence, and have thus far observed no toxic effects from it, although I have been accustomed to prescribe it in doses of one-half grain.

The extract of *convallaria* in 5-grain doses has been employed by Sansom with success in valvular affections. He found it to increase the intravascular pressure and to strengthen the cardiac systole. I have had little experience with this drug.

Caffeine is most successful in cases in which œdema is a prominent symptom, and is, unquestionably, a powerful diuretic. The alkaloid

[1] *University Medical Magazine*, Jan. 1889.

is decidedly superior to the citrate, although the latter is commonly prescribed, and should be given in doses of from 3 to 6 grains. It is most effectively used in connection with digitalis. On account of its tendency to produce insomnia it should be given mostly during the morning hours.

Arsenic is of decided value as a heart and nerve tonic, and may be administered during the intervals in which the use of digitalis or strophanthus is suspended. Balfour esteems it very highly, ranking it, in fact, next to digitalis, and finds it of special service in cases attended with anginal symptoms.

The positions of adonidine and chloride of barium, in the treatment of valvular disease, are decidedly subordinate, while that of casca, lauded by Lauder Brunton, is still more uncertain.

Bleeding.—In a certain number of cases, a critical evacuation of blood, whether as the result of accident or design, may turn the scale in favor of recovery when otherwise death would inevitably ensue. An instructive instance of the beneficial effect of loss of blood in an advanced stage of hyposystole, is related by Dr. Bedford Fenwick.[1] The case was in the London Hospital, under the care of Dr. Andrew Clark, by whom it had been classified as one of mitral stenosis with aortic incompetence. Digitalis, ether, and senega were given with little benefit. "The urine became scantier, œdema increased, and coma seemed supervening." At this juncture the patient accidentally struck his nose during the night and lost from twelve to fourteen ounces of blood. This accident was followed by immediate and decided improvement; so much so that "in less than a week the œdema was perfectly gone, his pulse was 80, his respiration 24, his appetite was becoming voracious, and he insisted on returning home, feeling better, he said, than he had done for months."

Herman Allyn reports a similar case,[2] and Fenwick gives the details of six cases which were all benefited more or less by the abstraction of blood. The following conclusions with which he ends his paper are endorsed by my own experience:

"1. In cases of valvular stenosis, if dyspnœa or pain or urgent symptoms be present, bleeding is generally useful. It appears to be better to bleed often if necessary, but to take only a small quantity each time, and this by means of leeches or the cupping-glass direct from the cardiac region.

"2. In cases of valvular incompetency, if urgent dyspnœa or cyanosis or stupor be present, it appears best to bleed freely from the arm to about sixteen or twenty ounces if necessary, and, if possible, once for all."

[1] "On the Use of Venesection in Cases of Heart Disease," *Lancet*, Aug. 5, 1882.

[2] *University Medical Magazine*, April, 1894.

Treatment of Special Symptoms.—For the gradually increasing *dyspnœa* which attends progressive failure of compensation we possess no specific remedies other than digitalis and its congeners. Benefit, in such cases, may sometimes be derived by increasing the dose or changing the preparation of digitalis or by resorting to the use of strophanthus, sparteine, or caffeine. As a rule, however, it will be found that *gradually increasing* dyspnœa unrelieved by digitalis is not benefited by anything else.

Sudden accessions of dyspnœa are much more amenable to treatment. They may be due to a variety of causes, chief among which are bronchial catarrh, spasm of the bronchial vessels (pseudo-asthma), genuine spasmodic asthma, acute pulmonary congestion, pulmonary œdema, renal insufficiency, etc.

A bronchial catarrh supervening in the course of valvular disease should be promptly treated with counter-irritation (dry cups, sinapisms, etc.), absolute rest in bed, and the internal administration of carbonate of ammonia in combination with digitalis and balsamic substances such as ammoniac, tolu, wine of tar, and terebene. Ipecac should be prescribed with caution, lest vomiting be excited, and preferably in the form of the wine. Morphine is often of decided benefit under these circumstances, and, in small doses, is a cardiac stimulant. The following prescription, which I have used with advantage in the bronchial catarrhs of heart disease, may be taken as a type of the medication I advise:

℞. Ammoniac., Tinct. tolut., āā ʒij (8.0);
Tinct. digitalis, ʒi–ʒij (4.0–8.0);
Morphinæ sulph., gr. ss (0.03);
Pulv. acaciæ, ʒij (8.0);
Aquæ, ad ℥vj (180.0).—M.
Sig. One tablespoonful every three or four hours.

Ammonium carbonate may often be advantageously added to the above prescription. When the dyspnœa has diminished and the catarrh is subsiding, potassium iodide, in combination with the aromatic spirit of ammonia, will be found of service.

Dyspnœa dependent upon spasm of bronchial arterioles is generally a uræmic manifestation, and it may be speedily relieved by the cautious inhalation of nitrite of amyl, after which nitro-glycerin in doses of $\frac{1}{100}$ grain three or four times a day should be prescribed. Better results may sometimes be obtained from nitro-glycerin in much smaller doses more frequently repeated. As recommended by Whitla, $\frac{1}{1000}$ of a grain every fifteen minutes or half an hour, may be given,

and by this mode of administration the headache, flushing of the face, and sense of fulness in the head often consequent upon the usual dose, may be avoided. At the same time, saline cathartics should be exhibited with the view of eliminating excrementitious substances.

The occurrence of spasm of the bronchial tubes (genuine spasmodic asthma) is, I believe, favored by valvular heart disease and should be treated in the usual manner, always bearing in mind, however, the importance of avoiding cardiac depressants such as chloral hydrate.

It is difficult, perhaps impossible, to draw a line of demarcation between the dyspnœa of acute pulmonary congestion and that of œdema of the lungs, and since the greater includes the less I will limit my remarks, under this head, to the treatment of the latter. The dyspnœa of œdema of the lungs is only equalled by that of membranous laryngitis. Unlike the latter, however, it is not of an inspiratory type, it being difficult to decide, in cases of œdema, which of the two respiratory acts is the more embarrassed. As the œdema progresses, the respiration becomes more rapid and labored and the usual signs of asphyxia appear. The skin and mucous membranes assume a cyanotic appearance; the sensorium becomes dulled; the patient falls into a semi-comatose state; the muscles twitch, and, finally, general convulsions set in and are soon followed by death. In most cases there is an abundant expectoration of frothy serum; in fact, this material, which is often tinged with blood, may issue from the mouth without any act of coughing, requiring to be frequently wiped from the patient's lips.

The prognosis is always most serious, but I have seen recovery take place, under suitable treatment, when the condition of the patient was apparently hopeless. I recall the case of a woman whose pulse was too rapid to be counted, whose chest was filled with bubbling râles, from whose mouth a blood-tinged frothy serum was constantly welling, and who nevertheless recovered, only to die several months later in a similar paroxysm.

In cases of œdema pulmonum the action of the heart must be maintained and strengthened with alcohol and ammonia and the hypodermic administration of strychnine, and the respiratory centre stimulated with atropine, which is best employed hypodermically. It is in these cases also that benefit may be obtained from the hypodermic use of a reliable preparation of digitaline or digitoxin. In addition, dry cups and sinapisms should be applied to the chest and the feet and legs immersed in hot water. If these measures are ineffectual and the heart is laboring, the venous system may be relieved and the patient saved from impending death, by venesection.

The treatment of uræmic dyspnœa occurring in the course of valvular heart disease does not differ materially from that of the same symptom occurring independently of cardiac lesion, with one important exception, which is that neither jaborandi nor its alkaloid, pilocarpine, should ever be prescribed. The tendency of this drug to induce pulmonary œdema renders it positively dangerous in heart affections.

Digestive disorders dependent upon valvular disease are all congestive and are best treated by a combination of digitalis and saline purgatives. In addition, the greatest care should be taken with reference to diet, such foods as are generally acknowledged to be indigestible, such as veal, pork, and salmon, being rigidly prohibited. An individual with heart disease should be especially careful to secure a daily evacuation of the bowels and may take with advantage twice or thrice weekly a dose of one of the stronger saline mineral waters or a teaspoonful or two of Sprudel salt dissolved in a glass of hot water. The same measures which are recommended for the treatment of gastro-intestinal congestion are applicable to that of the liver and kidney. There is a tradition, apparently well founded, that calomel exerts an antiphlogistic action upon the liver. Be this as it may, there is no question concerning the diuretic action of this drug in cases of heart disease. It is, therefore, peculiarly appropriate in cases of portal congestion, inasmuch as it not only depletes the vessels of the gastro-intestinal tract but, at the same time, increases the secretion of urine. It may be given for these purposes to the extent of from 5 to 7 grains *per diem*, in divided doses.

Œdema and Serous Effusion.—The earliest undoubted sign of failing compensation is œdema, which first manifests itself in the evening in the feet and about the ankle-joints. Up to the appearance of this sign, the condition may have been one of "eusystole," and may still deserve that term so far as the subjective symptoms are concerned. Œdema of dependent parts, however, indicates a degree of diminished arterial tension which calls for digitalis, and which, under the use of this drug, together with mild saline purgation, may promptly disappear. The physician, however, frequently encounters cases in which, either through neglect or inefficient treatment, the œdema is widespread and associated with effusion into the large serous cavities. In such cases the loose tissues of the scrotum are often enormously distended and may envelop the penis to such an extent that micturition is accomplished with difficulty.

Even under such circumstances the dropsy may entirely disappear under the use of digitalis, purgatives, and diuretics. The best purgative under these circumstances is magnesium sulphate given in the manner recommended by Hay, *i. e.* 2 ounces of magnesium sulphate

dissolved in 2 ounces of water and taken after ten or twelve hours' abstinence from food or drink. Enormous amounts of fluid may be drained away through the intestine by such a dose, which may be administered twice or thrice weekly. If the stomach cannot tolerate such a dose, the compound jalap powder, elaterium, or calomel (in a single dose of 5 grains) may be substituted. The latter is sometimes powerfully diuretic as well as purgative.

Among diuretics proper, caffeine, theobromine, and diuretin are among the best in cases of cardiac dropsy. The first-mentioned may first be tried, and should be given in large doses—5 grains three or four times daily. Barié recommends an initial dose of 1 gramme. The alkaloid caffeine should be employed in preference to any of its compounds, such as the citrate, valerianate, or bromhydrate. Caffeine may be administered to the best advantage hypodermically. The following solutions for hypodermic use are recommended by Tanret:

℞. Sodii benzoat.,	gr. xlv (3.);
Caffeinæ,	gr. xxxvii (2.5);
Aquæ destillat.,	f ʒiss (6.).—M.

Each syringeful (one cubic centimetre) contains 25 centigrammes (4 grains) of caffeine, which dose may be repeated three or four times daily.

℞. Sodii salicylat.,	gr. xlv (3.);
Caffeinæ,	ʒj (4.);
Aquæ destillat.,	f ʒiss (6.).—M.

Each cubic centimetre contains 40 centigrammes (7 grains) of caffeine.

Theobromine (dose 5–15 grains several times daily) may be passed by in favor of diuretin, which is a sodio-salicylic compound of theobromine and is more efficient than the latter. It may be given, in divided doses, to the daily amount of from 50 to 120 grains, although 5 grains every two hours at first, later every three hours, are usually effective. The following formula for the administration of diuretin has been recommended:

℞. Diuretin,	4 to 6 parts;
Aquæ menth. pip.,	100 "
Aquæ destillat.,	90 "
Syr. simp.,	10 " —M.

Two tablespoonfuls every two or three hours.

There are cases in which the effusion, subcutaneous and serous, remains uninfluenced by any of the above-mentioned internal reme-

dies, presumably because they are not absorbed. Under such circumstances we may imitate the process by which nature often relieves excessive tension, by puncturing the skin of the legs and scrotum with a lance-shaped needle. By this method several litres of serum may be evacuated in the twenty-four hours, and when the pressure upon lymphatics and veins is thus diminished the internal remedies are more likely to become operative. It must be confessed, however, that both discomfort and danger to the patient arise from this simple procedure: discomfort from the moisture, which it is difficult to keep from saturating the bed-clothing, and danger from erysipelas and gangrene, which may have their points of departure from the punctures in spite of all possible antiseptic precautions. Having once excited gangrene by puncture of an œdematous scrotum, I am naturally somewhat loath to resort to this operation or to recommend it to others.

Paracentesis abdominis is rarely necessary in cases of valvular disease, but I have often had occasion to resort to puncture of the pleural sac, and with benefit. In cases of increasing dyspnœa the thorax should be carefully examined, and, if pleural effusion is detected, it should be removed. We can expect nothing from drugs in the face of such a mechanical obstruction as pleural effusion. Paracentesis thoracis, under these circumstances, is more than palliative, for it not only relieves the dyspnœa immediately, but places the patient in a more favorable position to profit by internal medication.

Syncope.—There is a form of syncope to which, so far as I know, little or no allusion is made in text-books and monographs, and of which I have seen several examples. The patients in whom I have observed it have been aged people with distinct signs of aortic stenosis and general atheromatous degeneration of the arteries. The syncopal attacks are sudden but not entirely unaccompanied with premonitions. The patient utters one or more incoherent, gasping sounds, indicative of alarm, and becomes unconscious; the pulse ceases to beat for several seconds; the face becomes ghastly pale, and respiration is imperceptible. Soon the pulse makes itself felt, very feebly and infrequently, respiration is resumed, and consciousness returns. Several such attacks may occur during the day and be repeated daily for years. An old lady under my care, who recently died in her ninetieth year, was subject to such attacks for the last two or three years of her life, which was undoubtedly prolonged by incessant watchfulness on the part of nurses and relatives. In cases of this kind I have found nitro-glycerin of the greatest service. In doses of $\frac{1}{200}$ grain three or four times daily, it may be continued, with occasional intermissions, for years. In addition the daily use of alcoholic stimulants

in moderation (two ounces of whiskey or three or four ounces of sherry) and strychnine will be found decidedly useful. The inhalation of ammonia, during the attack itself, should be resorted to. Digitalis is decidedly contraindicated in these cases, in which, in my experience, the pulse is slow, rarely exceeding 40 to the minute, and often beating for weeks at the rate of 35 to 38.

Embolism and Hæmorrhage.—There are no medicinal means of treating embolism, whether it occur in the vessels of the kidney, intestine, lungs, or extremities. I have seen death result from embolism of the femoral or popliteal artery in two cases, and, in one case, from embolism of the axillary. In none of the three was amputation thought advisable, the patients being in an advanced stage of valvular disease. In embolism of a pulmonary vessel, indicated by pain, spitting of blood, and sometimes by signs of consolidation, absolute rest, an ice-bag to the chest over the area of infarction, and small doses of morphine, are the most important therapeutic measures. Hæmorrhage from mucous surfaces is to be treated on general principles, and is sometimes, as above stated, a favorable occurrence.

FATTY OVERGROWTH AND INFILTRATION—FATTY HEART.

Fatty heart is not to be confounded with fatty degeneration of the heart, although the two may be associated. It is usually but a part of a general condition of obesity, and may be of all grades from a slight increase of the subpericardial adipose tissue normally present, to a complete envelopment of the heart in a layer of fat which may attain a thickness of more than one centimetre. Under the latter circumstances, the fat may penetrate between the muscular fibres, separating, pressing upon them, and leading to their atrophy. This constitutes the condition called fatty infiltration, and with it there is usually associated more or less fatty degeneration. It is manifest that a heart thus overloaded and infiltrated cannot properly perform its function, although it must be confessed that many corpulent individuals, whose hearts are presumably surcharged with adipose tissue, may attain a ripe old age and lead a life of considerable activity, both mental and physical. The wide variations in the cardiac symptoms of the obese are doubtless due to varying degrees of atrophy and degeneration of the heart fibres.

The causes of fatty overgrowth and infiltration are the same as those of obesity in general, viz. a luxurious and indolent mode of life and over-indulgence in the pleasures of the table, with, in most cases, an hereditary tendency to the storage of fat. The treatment should, therefore, consist chiefly in restricting the diet in accordance

with one or other of the well-known dietary systems for reducing obesity, of which the chief are those of Banting, Ebstein, and Oertel.

The principles involved in these various dietary systems are comprised in the following daily *menu*, as given by Yeo:[1]

Morning.—One cup of coffee or tea with a little milk, altogether about 6 oz.; bread, about 3 oz.

Noon.—3 to 4 oz. of soup; 7 to 8 oz. of roast or boiled beef, veal, game, or not too fat poultry, salad or a light vegetable, a little fish (cooked without fat); 1 oz. of bread or farinaceous pudding (never more than 3 oz.; 3 to 6 oz. of fruit, fresh preferred, for dessert. It is desirable at this meal to avoid taking fluids, but in hot weather, or in the absence of fruit, 6 to 8 oz. of light wine may be taken.

Afternoon.—The same amount of coffee or tea as in the morning, with at most 6 oz. of water; an ounce of bread as an exceptional indulgence!

Evening.—One or two soft-boiled eggs, an ounce of bread, perhaps a small slice of cheese, salad, and fruit; 6 to 8 oz. of wine with 4 or 5 oz. of water.

Schweninger has modified this diet by entirely suppressing all beverages at meals, only permitting fluids two hours after eating.

Another and, perhaps, the most important part of the Oertel method is out-door exercise in the form of "systematized hill-climbing." This has been widely recommended, on the authority of Oertel, by many writers who have had little or no experience with it, and has been added to the innumerable "cures" of Germany under the ridiculous, mongrel title of "Terrain-Kur." Those who have had any experience of mountain climbing are well aware of the strain it imposes upon a healthy heart and would be loath to recommend such exertion to any one afflicted with heart disease even in its mildest forms. I believe, with Burney Yeo, that the most appropriate exercise for the obese is walking on level ground, and this opinion is spreading. The method of Oertel is losing its popularity. "The painted posts and indications are, indeed, still to be seen in many a picturesque spot where the Terrain-Kur was established. The paths and indications are there, but the invalids are not!"

The Schott method of baths and exercises described in another section finds one of its best applications in the treatment of fatty heart.

Internally, the occasional employment of saline purgatives, preferably in the form of Sprudel salt, is advisable. If the patient is anæmic or chlorotic, ferruginous preparations are indicated. Thyroid extract is worthy of a trial, but should be used under careful medical supervision, as symptoms grouped under the term "thyroidismus," among which are cardiac weakness and palpitation, may attend its administration.

[1] *Food in Health and Disease.*

FATTY DEGENERATION.

THIS is a degeneration of the muscular fibre of the heart, and may occur without fatty overgrowth or infiltration of that organ, or the excessive deposit of fat elsewhere. In fact, it is probably most frequently encountered in spare individuals. Its principal causes are protracted anæmia, whether primary or secondary, phosphorus-poisoning, dilatation of the cardiac cavities from valvular disease, and the impaired nutrition incident to old age. The latter variety, with which the practitioner is chiefly concerned, constitutes an independent cardiac affection, while the others above mentioned are, manifestly, of subordinate importance. In my opinion, the fatty cardiac degeneration of advanced life is usually the result of protracted anæmia of slight degree. Such anæmia may continue for years without giving rise to grave disturbances of health, while all the time its denutritive action upon the heart is steadily progressing. Finally, signs of cardiac failure, such as dyspnœa on slight exertion, a sense of præcordial oppression, or an attack of syncope, manifest themselves and induce the patient to consult a physician. Stokes laid especial stress upon the diagnostic importance of three symptoms of this disease, viz. infrequency of the pulse, apoplectiform attacks, and Cheyne–Stokes breathing. The last is a late manifestation, and usually indicative of a speedily fatal termination; but the two former may be present for several years. The pulse is not always reduced in frequency, but is invariably soft and compressible and often irregular and intermittent. The first sound of the heart is short and quick, closely resembling the second, and has been well described by the term "slapping." The apoplectiform attacks, which are by no means constantly present, are the most alarming feature of the disease. They may be of daily occurrence or, as I have seen, they may recur several times daily. They consist of sudden loss of consciousness, lasting but a few seconds as a rule, during which the action of heart and lungs is suspended, and death is apparently imminent. They are doubtless due to cerebral amæmia, but differ from ordinary attacks of syncope in several particulars, and especially in the suddenness and completeness with which consciousness is regained. For example, the patient recovering from one of these attacks will often immediately resume a suspended occupation, such as knitting or sewing, or endeavor to complete an interrupted sentence. In this respect these attacks resemble those of epilepsy.

The *treatment* of this condition is chiefly prophylactic and palliative. Cases of chlorosis and anæmia should be carefully and continuously treated with the view of preserving the integrity of the heart. The disease once recognized, the patient should be warned

against over-exertion and, at the same time, encouraged to take moderate exercise, either active or passive (walking and driving) in the open air. The bowels should be carefully regulated—an important precept, for, in my experience, there is, in this disease, a tendency to obstinate constipation. Digitalis may be tried in cases in which the pulse is irregular, but, as a rule, it is of little service and sometimes seems to aggravate the symptoms. I have obtained the best results from the long-continued administration of strychnia and nitro-glycerin. The latter is especially efficacious in the cases with frequently recurring apoplectiform attacks. During the latter, inhalations of ammonia are usually sufficient to restore the patient to consciousness, and these failing, nitrite of amyl may be employed. If the patient is anæmic, as is generally the case, a bland preparation of iron such as the lactate, malate, or potassio-tartrate, or, if the stomach will tolerate it, the more efficacious sulphate, may be prescribed. Goodell's pill of sulphate of iron, extract of sumbul, and strychnine is an excellent combination, to which, if constipation exists, a little aloes powder or extract may be added.

The diet should be nutritious and easily digestible, and a little wine, two or three ounces of sherry or claret, should be taken at the midday and evening meals. A little sherry and egg (an egg well beaten up, to which is added an ounce of sherry and the same amount of water, with a little sugar) may be taken with decided advantage in the morning on rising. In addition a little milk-punch, or whiskey and water, may be taken at 11 A. M. and 4 P. M. Such an amount of stimulants is not always necessary, but, in many cases, it is decidedly beneficial. Many individuals with this affection of the heart are very small eaters and have for years been living on an insufficient diet. The improvement in their condition induced by this mildly stimulating plan of treatment, combined with tonics and laxatives, is often remarkable.

NEUROSES OF THE HEART.

Palpitation.—Palpitation of the heart may be subjective or objective, or both. It is subjective when the patient is unpleasantly conscious of the action of the heart and when, at the same time, physical examination reveals neither increased force nor frequency of its beats, nor in fact any abnormality in the behavior of the organ. This variety of the affection can only be accounted for on the hypothesis of a hyperæsthesia of the sensory cardiac nerves. On the other hand, the most violent action of the heart may be attended with few or no unpleasant sensations. Palpitation is a frequent attendant of organic cardiac disease, but with that variety we are not at present concerned. The diagnosis of nervous palpitation is only justified when the most

careful physical examination fails to detect any organic disease of the heart.

Nervous palpitation is of two kinds, the one associated with disease, functional or organic, of other organs; the other existing independently of such association, and therefore presumably dependent upon a disturbance of the nervous apparatus of the heart itself.

Palpitation in all its varieties is frequently observed at the period of puberty, and may be either a part of the general nervous erethism of sexual development or the result of masturbation. It is a frequent attendant of anæmic conditions, whether these be primary or the result of hæmorrhage, protracted lactation, acute infectious disease, or sexual excess. In the latter instance, anæmia and exhaustion of nerve-centres co-operate in its production. Other well-recognized causes of the affection are over-exertion, gastro-intestinal disorders, helminthiasis, biliary and renal calculi, floating kidney, and ovarian and uterine disease. It is probable that the uric acid diathesis is often concerned in its production.

Toxic varieties of this disorder are such as are dependent upon the use or abuse of tea, coffee, tobacco, alcohol, cocaine, and opium.

In its purest form, palpitation is best described by the term "hysterical."

One serious attack of palpitation, whether it be of toxic origin or the result of over-exertion, sexual excess, or other cause, is apt to leave the patient in a neurasthenic condition, of which the principal symptoms are dyspnœa and tremor on slight exertion or mental excitement, palpitation often entirely subjective, a more or less complete loss of self-confidence with reference to physical exertion, and a continual apprehension of death from cardiac failure. The patient may continue for weeks in a pitiable condition, afraid to raise his head from the pillow and dreading to fall asleep lest the heart should cease to beat. These cases are, in my experience, more frequent in men than in women, especially men who have been long subjected to the severe strain of active business life, or who have had an unusual load of sorrow or anxiety to bear. I believe that the uric acid diathesis is often largely concerned in the production of these symptoms.

No matter how skilfully the above-described condition may be treated, time is the most potent healer, I might almost say the only one. The cases seem to run a self-limited course which, at its shortest, is counted by months, and may last longer than a year. The affection is entirely mental, a form of hysteria, and, therefore, diversion, especially such as is obtained by travel, is of the greatest service. I knew a man suffering from this affection who walked slowly and with difficulty, leaning on the arm of a friend, to the water's side to witness a boat-race. At the beginning of the race he was listless and

languid, self-absorbed and furtively feeling his pulse. As the boats neared the finish and the excitement became intense, he was carried away by it, and forgetting all about his heart, he ran to the top of a small hillock to obtain a better view and was among the first to reach its summit.

The treatment of palpitation of the heart should be directed, first of all, to the removal of its cause. Manifest indications are furnished by chlorosis and anæmia, the abuse of tobacco, alcohol, tea, and coffee, and by the use of cocaine and morphine. The same is true of sexual excess and masturbation. It is a safe rule, in most cases, to prohibit absolutely the use of tobacco and alcohol and to enjoin great moderation in that of tea and coffee. A diet largely vegetable is the most appropriate. A saucer or two of oatmeal porridge or some wheat food, with a glass of milk and an egg, is an ample breakfast. At midday a mutton chop or its equivalent in some other meat is abundant in the way of animal food. In the evening, a glass of milk may again be taken, with bread and butter *ad libitum* and some apple-sauce or stewed fruit, dried or fresh. This may seem a somewhat spare diet, but in the lithæmic it will actually be found to be more strengthening than large quantities of butcher's meat, which chiefly serve to poison the system with the products of their indigestion. Among the remedies directed especially to the heart are the bromides, valerian, asafœtida, ammonia, sumbul, strychnine, digitalis, strophanthus, barium chloride, adonidine, *et id genus omne*. Arsenic as a general eutrophic may be continuously employed, and will be found particularly efficacious in combination with iron in the anæmic cases, and especially when there is pain in the region of the heart. Barium chloride, preferably given in pill form in doses of from $\frac{1}{10}$ to $\frac{1}{8}$ grain, is a good cardiac tonic and analgesic which I have employed with apparently good results.

In all cases of palpitation, but especially in those with an hysterical basis, the most important elements of cure are a thorough confidence on the part of the physician in his diagnosis and the consequent ability to assure the patient that his recovery is largely a question of time.

Essential Paroxysmal Tachycardia.—As implied by its name, this affection is characterized by rapid action of the heart occurring in paroxysms and without manifest cause. The onset of the paroxysm is sudden, without any apparent exciting cause, either mental or physical, the pulse suddenly running up to 150, 200, or even to 250 beats per minute, and it subsides as suddenly as it arose. Its duration may vary from a few minutes to many hours. This neurosis has been variously attributed to paresis of the vagus, to stimulation of the sympathetic, to both of these states combined, and, finally (by Mar-

tius), to an acute dilatation of the heart. Without attempting to discuss these different theories, which would be here out of place, I will merely say that the weight of opinion, as well as the facts, seems to me to favor the theory of paralysis of the pneumogastric. In explanation of this supposed paralysis, Kelly,[1] who reports four cases of the disease, suggests a retraction of the terminal filaments (dendrites and neuraxons) of the pneumogastric, and the consequent temporary withdrawal of its inhibitory influence.[2]

The disease does not necessarily interfere either with health or longevity. The most remarkable case of which I have knowledge is that reported by Professor H. C. Wood,[3] the patient being a distinguished physician of Pennsylvania who, after suffering from paroxysms of tachycardia in its most pronounced form for more than fifty years, died in 1896 at the age of ninety-two.

Various measures have been employed, more or less successfully, to arrest the paroxysm, chief among which are the rapid deglutition of a glass of ice-water or a number of small pieces of ice (a cup of hot tea or coffee is equally efficacious); holding the breath and straining, as in the act of defæcation; deep respirations; the application of an ice-bag or cold douche to the chest or abdomen; pressure on the vagus in the neck and electrical stimulation of the same region; and the induction of vomiting. Absolute rest in the recumbent posture should be enjoined. If the attack is protracted, a hypodermic injection of morphine may be administered. During the intervals between the paroxysms, the patient should lead a well-regulated life, avoiding excessive fatigue or undue exertion, either physical or mental; in short, paying the strictest attention to the laws of hygiene. Tobacco and alcoholic stimulants should be absolutely prohibited. If, during the attack, there are signs of dilatation of the heart, digitalis may be tentatively administered, but as a rule this and drugs of similar action are of little service.

Bradycardia.—An abnormally infrequent pulse is seen in a variety of pathological conditions, such as icterus, diseases of the digestive system, anæmia, diseases of the brain and medulla, and in poisoning from tobacco, alcohol, digitalis, and lead. It is most frequently seen during convalescence from acute infectious fevers. With our present knowledge, however, we must recognize a certain proportion of the cases as functional, inasmuch as they cannot be proved to depend upon an anatomical basis or a toxic agency. In the well-known case reported by Prentiss of Washington, in which the autopsy was per-

[1] "Essential Paroxysmal Tachycardia," by Aloysius O. J. Kelly, M. D., *Medical and Surgical Reporter*, Oct. 24, 1896.

[2] I refer those interested in the discussion of this etiological question to Kelly's interesting paper.

[3] *University Medical Magazine*, March, 1891.

formed by Robert T. Edes, the examination yielded practically negative results. In this case the pulse ranged from eleven per minute to forty per minute for over two years. Prentiss[1] gives abstracts from 94 cases, of which one had a pulse of four per minute for four consecutive minutes. The principal symptoms are attacks of syncope, epileptiform convulsions and delirium, which may be maniacal. As causes of the functional form of bradycardia we must assume an irritation of the pneumogastric, either direct or reflex, or diminished excitability of the ganglia of the heart.

The treatment is unsatisfactory, consisting chiefly of alcoholic stimulants, ammonia, camphor, strychnine, belladonna, and strong coffee, or caffeine. Prentiss's patient was apparently relieved by bromide of ammonium. The affection is not necessarily fatal; in other words, an abnormally slow pulse is not incompatible with health and vigor. Case LXXV. of Prentiss's collection, reported by Squire, was a man of eighty, whose pulse was ordinarily twenty-eight per minute, and who nevertheless was unusually vigorous, only showing signs of dyspnœa when going up-hill or making other physical exertion.

Angina Pectoris.—Two varieties of this affection are generally recognized: the one dependent upon organic disease of the blood-vessels in the immediate neighborhood of the heart, especially the coronary arteries, valvular disease, and diseases of the myocardium; the other having its starting-point in widespread vascular spasm. The latter is sometimes called pseudo-angina. Yeo[2] regards angina pectoris as "a neurosal incident of cardiac disease," and does not believe in a pseudo-angina dependent upon vascular spasm. In the graver forms, according to this authority, there is serious organic disease of the heart or blood-vessels, or both, while in the milder we have simply to do with a cardiac neuralgia or hyperæsthesia.

An attack of angina is sudden in onset and often without manifest exciting cause, occurring, for example, when the patient is lying quietly in bed, perhaps asleep. It is chiefly characterized by a sense of great oppression in the region of the heart, and excruciating pain which, through irradiation, may extend to other parts of the body, especially the left upper extremity. Dyspnœa is by no means a constant symptom, and the action of the heart is variously affected, being sometimes slow and arrhythmic, at other times rapid and irregular, while again it may not be appreciably disturbed.

There are the widest differences as to duration and recurrence of the paroxysms. An attack may last but a few minutes or may continue for hours. The first attack may be fatal, or the paroxysms may

[1] *Transactions of the Association of American Physicians*, vol. iv.

[2] *Practitioner*, May 1893.

recur daily for many weeks, while on the other hand there may be intervals of weeks or months between them.

As in all paroxysmal disorders, the treatment comprises the management of the attacks and the course to be pursued in the intervals between them.

At the moment of an attack the nitrites are to be resorted to and are generally effective. Yeo discusses the mode of action of these drugs and concludes that it is extremely doubtful whether the relief they afford is wholly due to their vaso-dilating action. Be this as it may, they are the most certain palliatives at our command. From 3 to 6 drops of nitrite of amyl should be poured on a handkerchief and held close to the patients' nostrils. If relief is not speedily obtained a tablet of $\frac{1}{100}$ grain of trinitrin should be dissolved in water and injected beneath the skin; or if this is thought unadvisable or objected to, a tablet ($2\frac{1}{2}$ grains) of nitrite of sodium may be given by the mouth and repeated every hour until three or four have been taken. In addition, diffusible stimulants, such as Hoffman's anodyne, sulphuric or nitrous ether, or the aromatic spirit of ammonia, may be administered. The hypodermic injection of morphine and the inhalation of chloroform may be resorted to in the severest cases, but are rarely necessary. Locally, hot mustard poultices (*i. e.* mustard stirred up with flaxseed meal) are of decided service.

In the intervals between the attacks, careful attention should be paid to the diet, which should be light and nourishing, and digestion promoted by vegetable bitters, such as quassia, gentian, and calumba. If the patient is gouty, butcher's meat should be reduced to a minimum or refrained from altogether, its place being supplied by milk, eggs, and fish. Tobacco, alcohol, tea, and coffee should be prohibited.

Elimination is considered of the utmost importance by Ord, so much so as to lead him to state that if he were restricted to one remedy in the treatment of angina, he would prefer sulphate of magnesium to nitroglycerin. In anæmic cases iron and arsenic should be prescribed, and even in those who are not anæmic arsenic is one of the best remedies. Another valuable drug in the intervals is the iodide of potassium, which may be given, with arsenic, in daily doses of 15 to 45 grains. The iodide is particularly serviceable when there are signs of degenerative changes in the blood-vessels. In my own experience, I have derived the greatest benefit from a drug of which I find little or no mention by writers on the subject of angina. I refer to aconite. In a case under my care at the Philadelphia Hospital, in which the paroxysms were of daily recurrence and frightful severity, complete relief was obtained from the tincture of aconite in doses of two drops every three hours. After several weeks of freedom from the attacks, the drug was stopped and they returned, only to disappear promptly on

the renewal of the treatment. The case was one presenting marked signs of aortic stenosis and insufficiency with considerable hypertrophy and dilatation. From my experience with aconite in true angina, I feel almost inclined to paraphase the statement of Ord by saying that if I were limited to one drug in its treatment I would select aconite.

HEART DISEASE AND PREGNANCY.

In connection with heart disease the question of sex is of the utmost importance. Other things being equal, the power of compensating valvular defects is doubtless as great in the female as in the male, but the supervention of pregnancy places the female at a disadvantage which is always serious and sometimes fatal. Even in the healthy female during pregnancy the reserve power of the heart is called into action. The total mass of blood is increased and respiration is interfered with by the pressure of the gravid uterus. To meet the extra demands upon the heart there ensues a physiological eccentric hypertrophy of the left ventricle. It is manifest, therefore, that a heart already crippled may become entirely incompetent during gestation. There is no medical question of greater practical importance than that of the relation between heart disease and pregnancy, and it has been carefully studied by some of the ablest clinicians. The conclusions at which they have arrived are, however, of little use to the practitioner unless he accepts the aphorism of Peter which forbids the maiden with heart disease to marry, the wife to conceive, the mother to nurse her infant.[1] Such a rule is too absolute, for there are undoubtedly cases of valvular disease, manifesting themselves by a distinct murmur, in which the heart is not only perfectly competent, but possesses sufficient reserve power to meet the demands of gestation. The writer, during his connection with the Woman's Hospital of Philadelphia as consulting physician, has seen a number of such cases, and is firmly of the opinion that valvular disease *per se* is no bar to marriage. At the same time, in unsuitable cases, he has not hesitated to "forbid the banns."

With reference to the question of the marriage of women with valvular disease, each case must be separately studied, and the intelligent family physician who has known the candidate for years and attended her in intercurrent attacks of illness is more capable of reaching a wise decision than the consultant who examines her but once or twice. I recently examined a woman thirty-four years of age who, for many years, has taught the art of dancing, not only by precept but by the most active kind of example, and had no difficulty in detecting a distinct aortic regurgitant murmur which had its origin in

[1] "Fille, pas de mariage; femme, pas de grossesse; mère, pas d'allaitement."

an acute rheumatic endocarditis from which she suffered some sixteen years previously. In this case, there is perfect compensation and but little hypertrophy. The regurgitation, although sufficient to give rise to a distinct diastolic murmur, is undoubtedly trivial and the woman might safely be permitted to marry. Fortunately for the physician he is relieved of a great deal of responsibility in cases of the kind under discussion, for his advice, if unpalatable, is almost certain to be neglected.

In deciding the question of the marriage of a woman with valvular heart disease her previous history as well as her present condition must be carefully considered. If the heart has shown signs of incompetence during attacks of bronchial catarrh or other ailments which are regarded as trivial by the healthy, it is not likely to withstand the strain of pregnancy. The social condition of the patient is also an important factor. A woman who is able to spend the latter months of gestation in a state of mental and bodily repose is manifestly more likely to pass the ordeal of parturition than one who is compelled to occupy herself with the duties of housekeeping. If, at any time, the patient has presented such signs of incompetence as marked dyspnœa on slight exertion, hæmoptysis, albuminuria, or œdema, the physician should positively refuse to sanction her marriage.

In the foregoing remarks no attempt has been made to discriminate between the various forms of valvular disease in their relations to gestation and parturition, and it is doubtful whether it is possible to do so with accuracy. The question is chiefly one of compensation, and this may be more or less perfect in each variety. Statistics, it is true, seem to demonstrate that mitral stenosis is the gravest cardiac complication of pregnancy, but this may be due to the remarkable frequency of this lesion in females. Of 62 cases analyzed by Herman Allyn,[1] 23 died and 37 recovered; in 2 the result was uncertain. "In the number of deaths are included all who died during pregnancy, at confinement, or within three weeks afterwards." Porak gives the mortality of 22 cases of mital insufficiency as 13.66 per cent., and that of 13 cases presenting aortic lesions as 23.07 per cent.[2] Larger figures might alter these results materially, but the question, I repeat, is one of compensation rather than of any particular lesion.

In the treatment of failing cardiac compensation in the pregnant woman, the same measures are applicable as in cardiac asystole in general. If these fail to restore the vascular equilibrium the question of inducing premature labor should be considered, and, pending its settlement, venesection should be practised. No definite rules as to the amount of blood to be withdrawn can be formulated. The object in

[1] *University Medical Magazine*, April, 1894.

[2] Quoted from Allyn, *University Medical Magazine*, December, 1895.

view is the relief of the laboring heart, and the best criterion of such relief is afforded by the respiration, which, from being difficult, oppressed, and shallow, becomes easy, tranquil, and deep. In one case the desired effect may be obtained by a venesection of six ounces, while in another twenty ounces may have to be withdrawn.

As regards the induction of premature labor, it may be stated, in general terms, that this procedure is most applicable in the early months of gestation. If serious symptoms appear before the sixth month it is evident that the gestation cannot proceed to term without the gravest danger to the mother, whereas, on the other hand, if they do not supervene until the seventh or eighth month, it may be expected that, under vigorous treatment, including venesection, the full period of pregnancy may be accomplished.

DISEASES OF THE BLOOD.

By RALPH STOCKMAN, M. D., F. R. C. P. Edin.

The subject of Diseases of the Blood has been so ably and exhaustively treated by Dr. Shattuck in an earlier volume of this System, that in a supplementary article such as the present, written within four years of the original publication, little new is to be said on most points. The broad clinical features of the different morbid conditions have been long clearly laid down and for the most part receive general acceptance, while the grosser and more easily recognized pathological changes in the blood and other organs have been described with accuracy and detail. It is when we come to deal with the finer pathology, and more especially with the etiology, of those diseases that our knowledge is found to be disappointingly vague and meagre, and in many if not in most of them it gives us few or even no indications for satisfactory treatment. In fact, our treatment of most of these conditions is still in the empirical and experimental stages.

During the past few years our knowledge has undoubtedly been considerably extended by a number of clinical and experimental observations, yet these have dealt chiefly with details, and for the most part do not represent any very striking or radical advances.

It is perhaps desirable to say here a word about the present classification of the so-called "blood diseases." In this category authors have somewhat arbitrarily included many conditions which produce anæmia, but which manifestly only affect the blood as a secondary consequence of the original disease, while diseases involving the lymphatic glands and other parts of the hæmatopoietic system are also generally described under this heading. It is plain that many of the conditions, such as melanæmia for instance, are clearly dependent on malaria or other disease, and that treatment directed solely to improve the blood will be quite inadequate until the *origo et fons mali* has been successfully dealt with. In the same way Addison's disease has been gathered into the list of diseases of the blood, although we have no authority for doing so from our scanty knowledge of the purposes which the suprarenal bodies subserve in the animal economy. Further, it is at present the custom for systematic writers to divide anæmias into two classes—primary or idiopathic, and secondary—and

this is admittedly to a certain extent a convenient clinical distinction, but it is doubtful if it is a scientifically accurate one. We know definitely that anæmia follows cancer, phthisis, lead-poisoning, hæmorrhage, etc., but we do not know definitely if in any single class of anæmias the blood is the seat of primary affection. In fact, as our knowledge advances and their causes become revealed, the so-called primary anæmias are gradually disappearing. It is certainly a misnomer to call such cases idiopathic, and if we use this term at all we should feel quite clearly that as yet we have simply failed to recognize the cause, and not that no cause for the condition exists.

The outcome of these considerations clearly is that the term "diseases of the blood" is rather a convenient designation than a scientific classification, and that it is at present made to include a somewhat heterogeneous collection of morbid conditions, some of which are very ill understood. But while admitting that the generally accepted classification is unsatisfactory, yet it would be premature and useless to attempt to classify these diseases more accurately until our knowledge has been considerably extended. It would probably be best provisionally to designate them as "diseases affecting the hæmatopoietic system," which does not tie one down to any theory and is sufficiently comprehensive to include not only all the elements of the blood itself, but also the glands and tissues which are more directly concerned in its manufacture and maintenance in a healthy condition.

CHLOROSIS.

In all cases of chlorotic anæmia the amount of hæmoglobin and therefore of iron in the red blood-corpuscles is seriously diminished. It may even reach as low as 20 per cent. on Gowers' hæmoglobinometer scale, but such a diminution is decidedly rare, from 30 to 50 per cent. being much more commonly found. The red corpuscles may be normal in number, but any number down to two millions per cubic millimetre as recognized by the hæmacytometer is not unusual. The following table shows the results which I obtained from the examination of 61 cases, all occurring in young women:

Number of patients.	Number of red corpuscles per c.mm.	Range of Hb.	Average of Hb per case.
6	4½ to 5 millions.	46–66 per cent.	52.6 per cent.
9	4 to 4½ "	30–60 "	44.8 "
11	3½ to 4 "	35–54 "	42.7 "
15	3 to 3½ "	22–44 "	33.2 "
10	2½ to 3 "	30–48 "	35.7 "
8	2 to 2½ "	20–46 "	31.6 "
2	1½ to 2 "	25–28 "	26.5 "

The alterations in form of the corpuscles are usually, but not always, slight, and the blood-serum is not at all deteriorated either as regards its solid or liquid constituents.

This condition of the blood cannot be regarded, however, as absolutely distinctive of chlorosis, seeing that it is found in other forms of anæmia and notably during recovery from hæmorrhage. Indeed, one cannot say definitely that any one clinical feature is pathognomonic of chlorosis, but when we find blood-changes of this character occurring in young women who still remain plump, and yet suffer from pallor, and from more or less marked cardiac, digestive, and menstrual disturbances, the whole forms a distinctly outstanding clinical picture which is one of the most familiar to physicians.

Etiology.—The etiology of chlorosis is so closely bound up with its successful treatment that a somewhat full consideration of this may not be out of place. It is now generally admitted that chlorotic anæmia does not arise from excessive destruction of red corpuscles, but is due to deficient formation or to actual loss of blood. Sir Andrew Clark and others have held that dyspepsia, and especially constipation, give rise to ptomaïnes in the intestinal canal, which, becoming absorbed, break down the blood-corpuscles. But, apart from the fact that many chlorotics do not suffer especially from constipation, the pale color of the urine and fæces indicate that fewer red corpuscles are being disintegrated than in healthy persons, while exact researches have demonstrated the absence of any special sepsis in the alimentary canal. Many other causes have been blamed, such as absence of light and fresh air, overwork, especially under bad hygienic conditions, all kinds of depressing and unhealthy emotions, indigestion, excessive or otherwise faulty menstruation, tight-lacing, etc. Most of these, however, must be regarded as predisposing rather than direct causes, and, as the result of the investigation of a large number of cases, I have come to the conclusion that the *direct* causes of chlorosis may be reduced to two, namely, insufficient supply of iron in the food, and loss of iron from the body by menstrual or other bleeding. Without doubt the onset of puberty and the consequent strain thereafter thrown on the body for some years by its rapid growth and development are powerful factors in determining the deleterious effect of these influences on the red blood-corpuscles. A certain number of cases undoubtedly are met with in which there has never been any unusual menstrual loss and in which the amount of food taken is satisfactory, but in these even normal conditions probably overstrain the rapidly growing organism.

Lloyd Jones holds that the changes in the blood seen in chlorosis are simply an exaggeration of what normally occurs at puberty in girls, at which time, he says, the specific gravity of the whole blood

falls, the fall being especially due to deficieney in hæmoglobin. These changes do not occur, he states, in the blood of boys, and hence their immunity from anæmia at an age when it tends specially to affect the other sex. He fails to explain, however, why this normal physiological process should go on to a pathological extent in some cases and not in others, and why chlorotic anæmia should often occur later in life.

Dr. Frederick Taylor has justly remarked that for any theory of the cause of chlorosis to be satisfactory, it must take into consideration and account for its overwhelming preponderance in the female sex and at or about the age of puberty. It seems to me that the following considerations fulfil the conditions: In women, and especially in young women, the number of red blood-corpuscles and the amount of hæmoglobin is considerably less than in men, and therefore the blood is less able to bear any extra strain thrown upon it. That such a strain occurs at puberty there can be no doubt, for not only the blood but the whole organism suffers in its nutrition at this epoch. Primary digestion is usually much interfered with, constipation is common and often very severe, while surprisingly little food is consumed in many cases, and all this while the girl is growing fast. From analyses of the daily dietaries of healthy men and women I have found that the amount of iron ingested equals on an average 8 to 10 milligrammes (about $\frac{1}{8}$ to $\frac{1}{6}$ of a grain) per day, while the analyses of five days' food of three chlorotic girls showed that they were ingesting only from 3.2 down to 1.2 milligrammes (about $\frac{1}{2\,0}$ to $\frac{1}{5\,0}$ of a grain) of iron per day. It has never been determined how much iron chlorotic women excrete by the bowel and kidneys, but healthy persons lose by these channels at least about 6 milligrammes daily. It is, therefore, at once apparent that with a loss of iron from the body which at all approaches the normal, and with such an insufficient intake, the result will be that the organism gradually becomes drained of its iron and there remains little or none from which new hæmoglobin can be formed. Of course in these cases the food will always supply a certain amount, but this is obviously too little to maintain the hæmoglobin at a healthy level.

That by menstruation a relatively large amount of iron may be lost is also made obvious by a very simple calculation: In 100 grammes of healthy blood there are about 45 milligrammes of iron. Now, during a menstrual period, say about six ounces of blood are lost; this means about 90 milligrammes of iron—that is, as much iron as a healthy person ingests in food during nine or ten days. In healthy women there are reserves of iron in the liver and spleen which can be at once drawn on to supply this demand, and hence the loss is easily borne and soon made up, but the anæmic have no such

reserves, and thus each period increases their lack of iron and hæmoglobin. It is certain, therefore, that loss of blood not only directly produces anæmia, but also prevents speedy recovery from it by draining off the reserves of iron in the body. As a corollary the amenorrhœa of chlorosis must be regarded as protective and beneficial, and as a result, not a cause, of the anæmia.

To summarize: All the causes of chlorosis, ordinarily enumerated, may probably be reduced to two *direct* causes:

(1) *Excessive menstrual loss,* or (much less frequently) other blood-loss. This may be relative, that is, too much for a weakly or rapidly growing organism to bear, or it may be actually large.

(2) *Insufficient ingestion of iron* with the food. Anything which diminishes the appetite diminishes the consumption of iron; therefore dyspepsia, constipation, unhealthy surroundings, mental depression, etc., all predispose to anæmia by lessening the amount of food consumed. In many cases both causes are combined. The anæmia of boys and of non-menstruating girls can be explained in this manner also.

Treatment of Chlorosis.

Administration of Iron.—Clinical experience has proven abundantly that the chief remedial measure in chlorosis is the administration of iron. Any one of the ordinarily used preparations suffices, as they can all be absorbed, and in the present state of our knowledge no one preparation can be definitely put before another merely as regards iron.

The state of the stomach, therefore, must be our chief consideration in choosing the form of iron to be used in any particular case. If, as so often happens, there is gastric irritability, the mildest and least astringent preparations do best, such as reduced iron, ferrous carbonate in one form or another, or one of the double salts, while the oxalate and lactate are also suitable. The protochloride and sulphate, although very largely used, are more irritating, and the ferric salts are both more irritating and more astringent than any of the others. Large doses are generally held to act more rapidly and efficiently than small, but in my opinion too much has been made of this, and, further, they tend to seriously disarrange digestion. No doubt, if a very large quantity of iron is present in the alimentary canal, the probabilities are that rather more of it is absorbed than if the quantity were small, but this is more than counterbalanced by the attending disturbances of primary digestion. I generally give one grain of reduced iron made into a pill with a small amount of extract of gentian thrice daily after food, and I find that it is invariably well borne by the stomach, does not tend to cause constipation, and acts

quite as quickly and efficiently as much larger doses. Two grains twice daily after meals is just as efficient and lessens the number of times of taking medicine.

There has been much discussion as to the mode of action of iron, some authorities holding that none of the metal is absorbed, and that it simply stimulates gastro-intestinal digestion so that more food is consumed and the iron of the blood is made up from the organically combined iron contained in our dietary. Bunge and others believe that iron in the bowel simply prevents the sulphides there present from separating out the iron of the food and thereby rendering it unabsorbable; but I have shown that sulphide of iron is as efficient in curing chlorosis as other iron preparations are, while bismuth and manganese, which are just as capable of absorbing sulphuretted hydrogen as iron is, have no curative effect. If Bunge's theory were correct, these and other drugs should act quite as beneficially as iron undoubtedly does, but they do not. Macallum has now actually traced in animals the absorption of inorganic iron salts by the mucous membrane of the bowel, and this should for ever set the question at rest. We have no knowledge of the amount actually absorbed from the human intestinal canal when iron is given medicinally, but even under the most advantageous circumstances it is always small, and probably does not exceed some milligrammes per day. After absorption it seems to be stored up in the liver and to be converted into organic compounds resembling hæmoglobin in constitution, but more simple, and these ultimately form the hæmoglobin of the red blood-corpuscles. The amount thus stored in the liver I found in healthy organs to vary from 0.182 to 0.310 gramme (about $2\frac{7}{10}$ to $4\frac{3}{5}$ grains) metallic iron, and as Bunge reckons the total iron present in the body of an adult at 2.5 grammes (38 grains), the liver is seen to contain a not inconsiderable proportion of the whole. The iron of the liver is, however, a very varying quantity.

From a practical point of view it seems hardly necessary to say much about the hypodermic administration of iron, as the cases are very few in which the drug cannot be tolerated by the stomach, and the results of subcutaneous medication are in no way superior to the commoner method. Rosenthal, Luton, Da Costa, and many others have reported cases of successful treatment. I myself have treated four patients in this way, administering once daily a dose of the citrate of iron and sodium equal to $\frac{1}{4}$ or $\frac{1}{2}$ grain of metallic iron. Recovery took place in a perfectly satisfactory manner, but not more quickly than when larger doses are given by the stomach. Solution of ferrous citrate, various so-called peptonates and albuminates of iron, solution of dialyzed iron or other preparations have all been given in this way, but no preparation thoroughly satisfactory for

hypodermic use has yet been proposed.[1] Whatever solution is used ought to be perfectly neutral, as little astringent as possible, and should be injected into the deep tissues of the back. If these precautions be taken no pain or discomfort results, but not more than ½ grain metallic iron should be given at a dose.

Iron can also be given with success *per rectum*. The best preparation is a thoroughly neutral and unirritating combination with albumin, and this may be given in large doses.

Hæmol and *hæmogallol* are two preparations made from blood, which have been proposed by Professor Kobert as being very readily absorbed and utilized, but my clinical experience has been that they are almost useless. *Ferratin*, a preparation made from the liver and containing about 6 per cent. of iron, is a little better than these, but by no means equal to the ordinary inorganic compounds. These preparations contain too little iron to be of much value, and the same is true of the various wines and other similar products of pharmaceutical enterprise which are so much advertised.

Blood and various preparations made from it I have never found of much value, as they are difficult to digest and do not contain a sufficient quantity of iron.

Manganese, which has a certain reputation as a hæmatinic, I have found to be absolutely useless in chlorosis. I am inclined also to the opinion that arsenic is of little or no value in chlorotic anæmia, although its effect in the anæmia of tubercle and in other forms is beyond dispute. In cases of chlorosis which I have treated with arsenic alone no improvement of the blood ever took place, but recovery immediately began whenever iron was substituted. This has been the experience of other observers also. The fact remains, however, that small doses of arsenic are very largely used as an adjunct to iron, and there is a very general belief that it stimulates blood-formation and hastens recovery.

As regards dietetic measures the greatest care should be taken to improve appetite and digestion. Good general surroundings and personal hygiene, along with the treatment of the ever-present dyspepsia or constipation, are of the utmost importance, as thereby the patient gets into the habit of taking large quantities of food and hence ingests sufficient iron. The same is true of country air, spa treatment, hydrotherapy, and massage, all of which are useful adjuncts to the more direct methods of cure. No specific dietetic rules can be laid down applicable to all cases, for the diet must be entirely regulated by the condition of the digestive organs. If gastric digestion is good, then an ordinary mixed diet is most suitable, and it can be modified to suit cases which suffer from constipation. If there be severe dyspepsia or

[1] For full information on this subject see J. M. Da Costa, *Therapeutic Gazette*, May, 1896.

gastric ulcer it is obvious that a dietary appropriate to these conditions must be prescribed. In all cases, however, iron must be given —for, once a patient is markedly anæmic, the amount of iron furnished even by an abundant dietary can only go a very little way toward providing the supply of that metal necessary for recovery. Say that the blood is deficient in iron to the extent of fifteen grains, it is evident that it will be a very long time before this can be made good from the small amount of surplus iron in an ordinary dietary.

Rest in bed is justly held to be an important element for the successful treatment of severer cases of chlorosis. Many patients do best if confined strictly to bed during the first fortnight of treatment, and some recover only after this has been strictly attended to. The most probable explanation seems to be that during complete rest the demand for oxygen is much less, and hence the diminished hæmoglobin can cope with it. The muscles at rest use very little, and hence the supply can be employed almost exclusively for purposes of nutrition, and thereby digestion and general health are improved. Slight cases of chlorosis, however, do best with an open-air life and a moderate amount of exercise. Violent exertion of all kinds should be strictly prohibited, as the strain thrown on the heart is apt to lead to dilatation.

Once the patient is fairly under treatment with iron and other measures there is a rapid improvement in the blood. The corpuscles, if deficient, generally reach the normal standard in about a fortnight or less, but the hæmoglobin lags far behind, and it takes usually four to six or eight weeks before its maximum is reached.

The value of treatment by purgatives requires perhaps more than a passing reference, seeing that the theory on which it is based has attracted much attention in our profession. In 1805, Hamilton of Edinburgh, conceiving that chlorosis was due to malnutrition consequent on constipation, proposed to use purgatives very largely in its treatment, but a perusal of his work does not convey the impression that he had any very striking success. In 1887, Sir Andrew Clark again brought forward this plan, founded on the theory that the anæmia is due to absorption of decomposition-products from the bowel. He used saline purgatives, but the mixtures which he prescribed contained very large amounts of iron, and hence no conclusions can be drawn from his observations. Besides this, the theory of the etiology of the disease on which his treatment was founded has since been proved erroneous. Further, observations have now been made on many cases which were treated by purgatives alone, and the unanimous verdict of many clinicians is that purgation *per se* has no direct effect in curing the anæmic condition. No one, however, denies its value as a means of general treatment in this as in many

other conditions where constipation is often a prominent feature. As regards massage exact observations have been made by J. K. Mitchell, who found that in all forms and grades of anæmia improvement took place in the number of red corpuscles. It was at first transient, but after repeated rubbings for an hour daily becomes permanent. There is a less marked and less constant increase in the hæmoglobin-value. The general toning up of the muscles and circulation tends also to promote recovery.

Many cases show a tendency to relapse, and hence prophylactic measures assume great importance. Seeing that undue menstrual losses and insufficient food are the two great immediate causes of chlorosis, prevention seems simple enough. If the patient be not placed under favorable conditions or remain subject to the causes which originally produced the anæmia, then treatment may be inefficacious or very prolonged. Therefore if the menstruation be relatively or absolutely too abundant, it should be diminished by giving ergot or by other measures. More important still is the cultivation, by exercise and all possible means, of an habitually good appetite and vigorous health, because thereby the blood is kept at a healthy standard.

SPLENIC ANÆMIA.

This is a little-known and ill-understood disease in which anæmia is a prominent symptom. According to Banti the deterioration of the blood is secondary to enlargement of the spleen; Kanthack regards the splenic hypertrophy as secondary and compensatory in character; while Von Limbeck has suggested that it is the last stage of the severe anæmia of syphilis or rickets. As a matter of fact our knowledge of clinical and pathological data bearing on the condition is as yet much too limited to enable us to come to any satisfactory conclusion as to its cause, but I have seen a case in which acquired syphilis, rickets, and malaria could with certainty be excluded from the patient's previous history. It has also been named "splenic cachexia," "splenic pseudo-leukæmia," "lymphadenoma splenica," and "primary enlargement of the spleen"—*splénomegalie primitive* of some French authors. The name splenic anæmia implies a theory as to the causation of the blood-changes, and is therefore not quite satisfactory, but it may be retained until improved knowledge gives us a right to name this state more appropriately.

This variety of anæmia occurs at all ages, but is apparently most frequent in male adults in early middle life, beginning with gradually increasing weakness and pain in the splenic region. The attacks of pain become more marked and more frequent, the spleen becomes greatly enlarged so as to cause a distinct swelling of the abdomen,

and there is pronounced anæmia. Extreme anæmia, great weakness, and death from exhaustion or hæmorrhage ultimately occur. The liver is usually enlarged to a moderate or considerable extent, there are attacks of perisplenitis often accompanied by very severe paroxysms of pain, and the temperature keeps up to about 102° or 103° F. There may be severe dyspepsia, sometimes with constipation, sometimes with profuse diarrhœa. The patient is sometimes cachectic, but may have a fairly well-nourished and healthy look, and may only complain of the "lump" in the left side. Hæmorrhages are common from the nose, stomach, bowel, and gums, and also occur into the retina, the spleen, and other viscera. The disease is generally progressive from bad to worse and runs its course in from one to four or five years.

The red blood-corpuscles may be diminished one-half or more, and the hæmoglobin falls in about an equal proportion; the red disks are not misshapen and there is no leucocytosis.

After death the fibrous trabeculæ of the spleen are seen to be much hypertrophied, there is atrophy of the Malpighian bodies, and the organ may weigh as much as six pounds. The liver has been found normal, but usually there is a large increase in its fibrous tissue and also in size and weight. As regards the amount of iron found in these organs different cases have yielded different results; in some no reaction to the ordinary tests for iron has been obtained, while in others there has been a decided increase, but no exact analytical estimations are recorded. Little also is known of the changes in the bone-marrow, but they, too, seem to be inconstant.

Banti thinks the condition may be a purely splenic form of pseudo-leukæmia (Hodgkin's disease), and that the spleen having become enlarged destroys the red corpuscles. This view, however, seems to be negatived by the fact that the iron arising from the destroyed corpuscles may be quite absent from the spleen and liver. Neither can the changes in the blood and nutrition be due to abolition of the functions of the spleen, as it is well known that men can live in good health after excision of that organ.

In a treatise dealing specially with the therapeutical aspects of disease some apology may be considered necessary for dwelling at such length on pathology and symptoms, but my excuse must be that the condition is at present little known to the profession generally, and that, when the attention of a wider circle has been drawn to it, advances in treatment may be confidently expected to follow.

Hitherto the results of treatment have been extremely disappointing. Arsenic, after a fair trial in a number of cases, has been almost unanimously pronounced to have practically no effect either in curing the disease or in arresting its course. The same is true of other drugs such as iron, quinine, ergot, and potassium iodide. Taylor, however,

states that he has seen temporary improvement follow on the simultaneous administration of arsenic, potassium iodide, and oxygen gas to the amount of 30 litres daily. Splenectomy seems to offer the best chance of saving the patient. In several cases the patient has survived excision of an enlarged spleen, but owing to the disease being little known and to meagreness of description it is difficult to judge if these were real cases of splenic anæmia. Further, it is often difficult to gather from the published accounts how long the patient lived after recovery from the operation, and this is a matter of great importance in judging of the ultimate value of the operation, as splenic anæmia is often a very chronic disease and the patient might have lived just as long without undergoing operation.

Spanton has collected 38 cases of "hypertrophy" of the spleen in which splenectomy was performed. Of these 18 recovered, but it is impossible to say whether they were all cases of splenic anæmia.

PERNICIOUS ANÆMIA.

A SATISFACTORY consideration of the therapeutics of pernicious anæmia is rendered very difficult by the complete absence of agreement as to what really constitutes the disease. As regards the clinical features there can be no dispute, as the excessive anæmia, the yellowish tinge of the skin, the extreme muscular and cardiac debility, the dyspepsia, and irregular febrile attacks with the tendency to hæmorrhages, enable one to diagnose the case almost at a glance. The hæmoglobin may be reduced to 10 per cent. and the red blood-corpuscles to 500,000 per cubic millimetre, but they are usually about double these numbers when the patient first applies for advice. There are marked alterations in the shape of the red disks, and there may be many microcytes and a few nucleated red cells. Great stress is usually put on the fact that the red corpuscles are diminished proportionately to the hæmoglobin, and this is often laid down as an essential point of difference between chlorosis and pernicious anæmia. I am inclined to think, however, that too much importance has been attached to it, and that this proportion is present in all cases of very severe anæmia from whatever cause.

Clinicians are now agreed that this profound degree of anæmia may be brought on by many conditions, and hence many hold that it is not a disease by itself, "a morbid entity," but is simply an extreme deterioration of the blood following on any one of numerous and varied preceding states. Certainly, whatever be the cause, or whether no definite cause be found, the symptoms are practically identical in all cases. Cases have been reported in which it has followed an atrophy of the gastric mucous membrane, ulceration of the intestinal canal, diarrhœa, severe hæmorrhage, pregnancy, lactation, typhoid and other

fevers, malaria, syphilis, chlorosis, and jaundice. Typical examples have been described where, post-mortem, malignant disease of the abdominal viscera or of the bones was present, and it is now established that the clinical features of so-called pernicious anæmia may be reproduced in every detail by intestinal worms such as the *Bothriocephalus latus* and *Anchylostoma duodenale*. The latter certainly induces the anæmia by direct withdrawal of blood, and hence acts like hæmorrhage, but how the former impoverishes the blood and why it only does so in certain cases is quite unknown.

On the other hand, many physicians have a totally different conception of what should be understood by the term pernicious anæmia, and hold that true cases are not secondary to other conditions. Dr. Pye-Smith insists that cases of extreme anæmia after pregnancy, diarrhœa, hæmorrhage, etc., are not true cases of the "idiopathic anæmia of Addison" where no cause is discoverable; and Dr. Hale White says: "For the case to be an example of the disease described by Addison it is essential that there should not be present any of the usual causes or concomitants of the anæmic state." They wish, in fact, to call "pernicious" or "idiopathic" anæmia only those cases in which we are ignorant of the cause, assuming that in these it is a primary blood-disease, and ignoring the fact that no disease can properly speaking be called idiopathic. Such a term simply implies that we do not know the cause, and since Addison's time we have discovered the cause in many cases which he might have classed as idiopathic.

Dr. W. Hunter has advanced a theory which has obtained wide support. He holds that pernicious anæmia is a distinct disease due to excessive blood-destruction, and that its most constant pathological feature is a large excess of iron in the liver, which distinguishes it from all other varieties of anæmia. He believes that the red blood-corpuscles are broken down by decomposition-products formed in the alimentary canal and absorbed into the portal circulation, the excess of iron in the liver being derived from the débris. Lépine holds a position somewhere between the two extremes in believing that the condition follows on causes generally recognized as predisposing to anæmia, but that there is superadded an individual weakness in blood-forming power which determines the great extent to which it progresses. Eichhorst, on the other hand, holds the opinion that some cases are "primary," "idiopathic," or "essential," and others secondary to exhausting conditions or diseases.

From the present evidence it seems most probable that pernicious anæmia usually follows loss of blood or well-recognized debilitating causes of one kind or another. The cause is, however, in many cases undetected, but these can hardly be regarded as idiopathic in origin. Further, it is improbable that a hypothetical wholesale de-

struction of red blood-corpuscles by the liver-cells or by a ptomaïne or ferment is the cause of the condition. Debilitating conditions are common enough, yet they are comparatively seldom followed by extreme anæmia, and we are as yet, in a broad sense, quite ignorant of the reasons for its occurrence in certain cases. In all cases it is the intense bloodlessness which is the cardinal feature of the disease clinically. The debility, breathlessness, yellow color of the skin, and excess of iron in the liver are of secondary import. In fact, I have shown that many cases of fatal anæmia present no excess of iron in the liver or spleen, and that in cases where iron pigment exists in large amount in these organs it may also be found in the brain, kidney, fatty tissue, etc., which can hardly be supposed to have any blood-destroying function. Whether this iron pigment arises from the hæmoglobin of internal hæmorrhages, or from red corpuscles which have been actively destroyed somewhere in the body is still in dispute.

Treatment.—Seeing that so many widely different causes may give rise to extreme and frequently fatal anæmia, our first endeavor should be to treat any case on etiological principles. Unfortunately this is only sometimes possible, as the causes underlying the anæmia are often discoverable only after death, or are not revealed even by the autopsy. To this ignorance is no doubt attributable in some degree at least the frequent non-success of treatment, while in addition many cases apply for advice only when they have reached a high degree of bloodlessness and when the extreme debility, gastric dyspepsia, and liability to diarrhœa stand greatly in the way of successful treatment. Although Habershon says that many patients in the early stage recover under iron and general tonic treatment, yet experience forces us to admit that in the ordinary run of cases the prognosis is extremely grave. Reliable statistics as to permanent cures are lacking, but Quincke reports 7 cures out of 21 cases, Müller 3 out of 44, and Pye–Smith 20 out of 110. Many of these so-called cures were certainly not permanent, as hospital cases especially are apt to drift out of ken and die without any information being communicated to their doctor. It is a common enough experience to have a case which recovers for some months or even for a year or two and then relapses and dies ; in fact, some few go on in this way for many years. It is known, however, that a few cases have made permanent recoveries, and if we include those cases due to intestinal parasites the number grows very considerably.

Cases secondary to malignant disease, to chronic gastric atrophy, or other necessarily fatal conditions may be dismissed at once as hopeless. Specific lines of treatment cannot be laid down for these : the patients must be treated on general principles, and the symptoms as they arise ameliorated as far as possible. Bitters and acids may be

given to assist digestion, while strict attention to the dietary and the administration of moderate quantities of wine certainly add greatly to the patient's comfort.

Wherever hæmorrhages from piles or from mucous surfaces are present these must be carefully and at once controlled, and so must diarrhœa, which seems to be specially exhausting and often precipitates the fatal termination. The diarrhœa is often most obstinate, but the best means of stopping it consist in putting the patient on a diet of boiled or peptonized milk, in giving opiates by the mouth, and starch enemata. Fifteen minims of laudanum and liquid extract of ergot every six hours often succeeds well, but, failing this, large doses of subnitrate of bismuth, solution of per-salts of iron, or other astringent measures may be tried. A history of syphilis or malaria may give us some guidance, but Müller's results with anti-syphilitic treatment are certainly not very encouraging: out of four only one case recovered.

In the anæmia of ankylostomiasis anthelmintic treatment is usually successful. This disease is endemic in Egypt and India, where it is answerable for a very large amount of chronic ill-health, and it has been carried to the Cape, Fiji, Trinidad, and other places by immigrant coolies. Several outbreaks have occurred in Germany, France, and Austria among miners, and in Switzerland and Italy among the navvies engaged in railway-tunnelling. The eggs of the parasite are found in the soil and are swallowed with food. The eggs are present in large numbers in the fæces and are easily recognized under a low power of the microscope, so that diagnosis is easy. The best treatment is by thymol, of which 20 grains dissolved in brandy or other spirit may be given once or oftener. Filix mas may also be used in appropriate doses—one or two drachms of the liquid extract in emulsion. Where the habits and surroundings of the patients are good they almost invariably recover under this treatment, but in coolies, who are filthy in their habits and are often dirt-eaters, deaths are not infrequent. Thus in Fiji, Hirsch reports 26 deaths out of 126 cases treated.

Bothriocephalus anæmia is most common on the shores of the Baltic, but it is probable that other kinds of tape-worm may give rise to fatal anæmia. Formerly all these cases died in spite of arsenic, iron, and other drugs, but now, when the causal connection between the parasite and the anæmia has been recognized deaths are rare, and this should lead us to hope that many other kinds of cases would be equally amenable to treatment if we only knew the cause. Filix mas readily kills the worm, and as soon as the latter is expelled recovery begins, and is usually complete in about six weeks.

Hunter, basing his treatment on the theory of intestinal sepsis, has advocated the use of a farinaceous diet with intestinal antiseptics

such as beta-naphthol, but I must confess that I have never seen much success follow this plan, although mercurials, guaiacol carbonate, and numerous other drugs of the same kind have been used in addition. Nevertheless, Sandoz reports a case due to excessive fermentation in the stomach and intestine, which was cured by persistent lavage, while Jürgensen states that a patient of his recovered after the expulsion of enormous numbers of *Bacterium termo* from the bowel. Cases which have been brought on by hæmorrhages, hardships, poor feeding, or by unknown causes are best treated by careful and nourishing feeding and by arsenic and iron. Arsenic is the drug on which experience has taught us to place most reliance. Its mode of action is not understood, but the most probable explanation is that it stimulates the formation of new corpuscles by the red bone-marrow. It has undoubtedly started many cases toward recovery, although too frequently this is not permanent, and disappointing relapses follow. It is usually given in 5-minim doses of Fowler's solution thrice daily after food, but of course the dose may be varied to suit the case. Iron does not usually make any marked improvement in the blood, and fails to cure or improve the patient's condition. In fact, the failure of iron to effect a cure has often been included in the definition of pernicious anæmia, but we should remember that iron is equally ineffective in the anæmia of such constitutional diseases as cancer and tubercle, and that where it fails it probably does so by not affecting the underlying cause. It is good practice to combine it with arsenic, because if the arsenic increases the formation of red blood-corpuscles it is necessary to supply sufficient iron to provide the necessary hæmoglobin.

Iron given alone, however, has often proved successful, and hence the general pessimistic view of its inutility is probably too extreme. Thus Quincke treated his seven cases of recovery with iron, and cases have been recorded in which arsenic failed to effect any improvement, but in which recovery subsequently took place under iron. It is sometimes very badly borne by the stomach, and in these cases may be given *per rectum*. Administration by subcutaneous injection has not proved more successful than by the mouth.

Phosphorus has been recommended, and occasionally seems to improve the condition of the blood, but on the whole its use has been disappointing.

Bone-marrow was first used by Dr. Dixon Mann,[1] who gave a glycerin extract in three cases of anæmia with asserted good results. Subsequently it was stated by Fraser to have cured a case of pernicious anæmia which had made no improvement under iron, arsenic, and salol, but immediately began to recover when three ounces of ox

[1] *Lancet*, 1894, i. 599.

and calf bone-marrow daily were added to the treatment. Barrs has also published a case in which arsenic had failed to effect any improvement, and in which he then administered bone-marrow without any other drug, when complete recovery took place in about two months. Since then several other cases have been reported in which bone-marrow has done good, as well as others in which it has been without effect, and as yet no definite opinion can be expressed regarding its real value. Whether it be red bone-marrow or yellow, it contains mere traces of iron, and in the latter case consists almost solely of fat. It may, however, possibly contain some active chemical principle which is of advantage in blood-formation, and the fact that glycerin extract is reported to be as efficacious as the marrow itself would, if it be true, lend support to the view. Further clinical and experimental observation is required to settle this question.

Transfusion of blood has very frequently been resorted to with the view of supplying the deficiency of blood-corpuscles. Only the blood of man should be used, as that of other animals is deleterious in many ways. Four to six ounces of blood should be withdrawn from the donor and rapidly mixed with one-third of its bulk of solution of phosphate of sodium made up to the specific gravity of blood-serum (about 1028) and kept at the temperature of blood in the body. This prevents coagulation and enables the mixture to be transferred without risk into one of the large veins of the patient's arm ; it should be done deliberately, about thirty minutes being occupied in allowing eight ounces to flow in. Very frequently transfusion produces slight temporary benefit, and in a few cases this has been permanent. Brakenridge[1] has reported five cases in which repeated transfusion was performed, but only one of these recovered, while Affleck has also reported a case which recovered after transfusion. In view of the fact that certain cases have recovered after transfusion it is probably worth trying after other means have failed, but it must not be forgotten that experience has shown its utter uselessness in the large majority of cases. No sufficient explanation of its action in successful cases has ever been given, but it has been suggested that healthy blood may act as an antitoxin in destroying some ferment which is breaking down the blood-corpuscle. Transfusion of saline solutions *per rectum* and intravenously to restore the bulk of the blood has at best only a temporary restorative action.

These articles form an abstract of various papers which I have published, and to which I must refer the reader for a full account of the literature and for the discussion of many points in the pathology

[1] *Trans. of the Medico-Chirurgical Society of Edinburgh*, 1891–92, ix.

and treatment of anæmia which are still in dispute. They are as follows:

"The Treatment of Chlorosis by Iron and Some Other Drugs," *Brit. Med. Journal*, 1893, i. pp. 881, 942.

"On the Nature and Treatment of Pernicious Anæmia," *Brit. Med. Journal*, 1895, i. pp. 965, 1025, 1083.

"A Summary of Sixty-three Cases of Chlorosis," *Edin. Med. Journal*, Nov., 1895.

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ADDISON'S DISEASE.

HERE the most outstanding clinical feature is the peculiar bronzing of the skin which is so characteristic of the disease, but it is preceded and accompanied by a very marked sense of muscular weakness, often of cardiac weakness, and more or less dyspnœa, all of which symptoms sometimes call for a good deal of treatment.

Its usual duration is about one to two years, but from a few weeks to eight years are the extremes in reported cases. Some few cases have apparently recovered, but this must be very exceptional, and speaking practically it runs a fatal course. Death may occur from asthenia, often hastened by severe diarrhœa, or may be due to tubercle or cancer, or some intercurrent complication. After death the suprarenal bodies are found to be involved in some gross lesion—tubercle, cancer, hæmorrhage, external pressure—or may have simply atrophied. In a few cases the semilunar ganglia and nerves in their neighborhood seem to be the seat of the lesion, the glands themselves being apparently healthy. In those cases in which I have examined the blood, both corpuscles and hæmoglobin were up to the normal healthy standard and there was no leucocytosis. The symptoms are directly connected with abolished function of the suprarenal glands, and are now generally held to be due to an inadequate secretion of some substance which is essential to life. This seems to have been proved by an experiment of Abelous and Langlois, who kept animals alive after excision of the glands by injecting an extract made from them. Why the absence of the secretion should cause pigmentation and extreme

weakness is quite unknown as yet, although Schäfer and others have found that the extract made from the adrenal bodies of animals stimulates the circulation and nutrition.

The theory has also been propounded that the function of the capsules is to excrete some toxic substance from the blood, but this explanation seems to be completely discredited by the above-mentioned experiment, in which the administration of the glands averted death after their excision.

Treatment.—Cases due to tubercle, cancer, etc. are necessarily fatal. Arsenic has hitherto been the drug most relied on, but I cannot say that much benefit has ever been recorded from its use. Lately preparations made from the suprarenal bodies of sheep have been tried, and not entirely without success, although we have not yet anything like sufficient experience to enable us to judge of the value of such treatment. Oliver has treated two cases with suprarenal extract by the mouth, and the patient gained weight, became less pigmented and free from dyspeptic symptoms. Rolleston and others have reported similar results, but as yet there has not been a case of complete cure.

I have had an opportunity of treating three cases with the suprarenal capsules of the sheep. I used the fresh glands and gave them minced and raw, my reason for so doing being that there is no means of testing the genuineness of the various extracts and dried preparations which are on the market, and no means of knowing how much, if any, of the active principles is contained in them. They agreed perfectly well and were taken without any trouble spread on bread and butter.

Two of my cases showed no improvement whatever and at the post-mortem examinations were found to have extensive tubercular disease of the glands.

The third case was a well-built, finely developed lad, eighteen years of age, with no signs of tubercular or other constitutional affection. He presented the classical symptoms of the disease, and dated his illness from six months previously, when he had begun to feel very weak and had noticed the bronzing of his skin. Some time before this he had fallen from a height on to a plank which caught him in the small of the back and strained it severely, but he recovered in a few weeks. Otherwise there is nothing of interest in the history. He got first two, then three, and then six sheep's capsules daily, without experiencing any unpleasant subjective symptoms. In six weeks there could be no doubt as to the improvement—he was slightly less brown, but was much stronger and had gained four pounds in weight. In ten weeks the improvement was more marked, when he was put on a glycerin extract. It is now twenty-one months ago: he is able to do an ordinary day's work, but although somewhat

whiter, he is still a good deal pigmented. A curious point is that after he first got strong enough to work he omitted taking the suprarenal extract, and in a very short time felt ill and weak again. I am inclined to regard this case as one of atrophy of the suprarenal bodies, possibly following on the injury to his back.

For the cardiac weakness and dyspepsia heart tonics, stimulants, and the ordinary routine treatment of such conditions is all that can be done.

HÆMOPHILIA.

LITTLE, unfortunately, can be added to what has been previously said in this SYSTEM regarding the treatment of the constitutional tendency to bleeding. Some observations of A. E. Wright,[1] although very incomplete, may be adverted to as indicating a possible method of ameliorating the condition, although, being constitutional and hereditary, it must be extremely doubtful if it is susceptible to curative treatment. In a case of hæmophilia he observed that blood withdrawn into the capillary tubes took nine or ten minutes to coagulate as compared with two and one-half to five minutes in the healthy subject. In both the blood was found to coagulate much more rapidly if calcium chloride solution in varying strengths was added to it outside the body. He accordingly administered 15 grains of calcium chloride thrice daily and found that on the two succeeding days the blood coagulated much more rapidly. On the third day, however, the coagulation time had increased very considerably, and owing to other circumstances the observations were discontinued. Wright states, however, that in recurring epistaxis and in hæmoptysis the tendency to bleed is much lessened by the internal administration of calcium chloride.

It is always difficult to judge of the real value of drugs in hæmorrhage owing to the tendency of bleeding to stop spontaneously, but, quite apart from this, Wright's observations stand greatly in need of confirmation.

[1] *British Medical Journal*, 1893, ii.

DISEASES OF THE LIVER.

By JOSEPH EICHBERG, M. D.

General Considerations.

The liver has long been the butt for much irrational but well-meant therapeutic effort. As a last refuge of the puzzled practitioner, when driven to bay for a diagnosis, "torpidity of the liver" has done yeoman service, though the mental picture conveyed by the term is never very clear either to the lay or medical mind. Accordingly, the diagnosis made, the liver is "stirred up" with the same unctuous satisfaction with which the artist gives his *coup de maître* to the unfinished canvas on his easel. It is certain that the function of this gland is frequently perturbed; it participates, to a greater or less degree, in nearly all the acute infectious processes—evidence of this is furnished by the altered structure recognized on the post-mortem table; it is reasonably certain that functional derangements unconnected with structural change occur in this as in other glands; but so little do we know of such processes, that all statements regarding them must be purely speculative and must be received as such.

The reader of that wonderful classic in medicine, Foster's *Physiology*, cannot have failed to note the frequent admission of an imperfect knowledge regarding the normal processes that take place in this gland, even with reference to those functions that are generally assumed to be its prerogative. When the normal process is but little understood, it follows that we can speak but doubtfully regarding departures from the healthy standard, such as we assume to occur as the result of disease of its texture. This is greatly to be regretted, from the practical point of view; for the aim of our science to-day is to approach more and more closely to a rational system of therapeutics, based on physiology, pathological anatomy, experimental study, and experience. The absence of proper physiological data limits the scope of our endeavor, and leaves us on a purely empirical footing.

The largest gland in the body, receiving according to Béclard one-fourth of the entire blood-supply, naturally should play an important rôle in the economy; and yet the recognition of its true physiological importance can only be said to begin with the labors of Claude Bernard. At the present day we recognize the activity of the liver—

1. As a heat-producing organ. The blood of the sub-hepatic veins is the warmest in the body, and differs in temperature from that of the portal vein and of the abdominal aorta (in the dog) by as much as 3° in some observations of Bernard, the average being between 1° and 1.5° F. The production of urea is probably associated with this function.

2. As influencing the destruction of the red blood-corpuscles, from which source some of the bile-pigment is doubtless obtained. Whether there is a regeneration of blood-cells in the gland is not known.

3. As a sort of *screen* to the economy, preventing the entry of poisonous principles, absorbed from the portal radicles, into the general circulation. Its function in this respect may be compared to that of the lymphatic glands in the lymph-circulation. The liver converts poisonous aromatic principles, which arise from the splitting up of albuminous compounds in the gastro-intestinal tract, into harmless products. According to Bouchard and Roger, it exercises the same influence over ptomaïnes and alkaloids, which are in part stored up in its cells, partially converted into indifferent compounds, and in part excreted with the bile.

4. It secretes the bile, which is both secretion and excretion, and which is largely again restored to the circulation.

5. It is the storehouse for glycogen—the savings-bank of the economy for that material which is most readily consumed for the production of heat and force, and which is the first to disappear when food is withheld.

How large a part it may take in other processes we do not know; that such discoveries may be made in the future is most likely. With the material at hand, it will still appear that our resources for the treatment of its diseases are very limited.

There are perhaps few glands in the body in which the difficulties of arriving at exact knowledge are greater: experiments upon the lower animals are wholly unsatisfactory, in that the results are at variance with clinical experience; and some of the best-established beliefs are overthrown in the same way, by isolated cases, where nature seems to prove the utter falsity of our position. Thus, we have always believed that the retention of bile, or rather the resorption of some of its principles, was necessary to protect the economy from great waste and drain; yet we have the case of Paton, where, following an operation, a woman remained with a complete biliary fistula, through which, according to the reporter, the whole of the bile escaped. The fistula remained open from June, 1890, to March, 1892. During this time the patient's health and strength steadily improved. She enjoyed a hearty appetite, eating all kinds of food, not excepting fatty substances, which were taken with impunity. There was no

disturbance of the bowels; they moved regularly once a day, without the aid of any cathartic.

We shall have occasion to refer presently to the so-called cholagogues; it is not amiss to give the experience of an eminent clinician regarding them. At the Congress for Internal Medicine, 1894, Naunyn said: "It is, however, certain that, *judging from experiments on animals*, none of the cholagogue remedies (not even excepting bile-acids) possess such an effect as could be compared with the cholagogue action of a full meal of mixed diet. After the latter, the flow of bile is incomparably more abundant than after the use of alkaline waters, salicylic acid, ether and turpentine, or even after bile-acids,—to say absolutely nothing of olive oil."

In some experiments to determine the action of sodium salts on the secretion and alkalinity of the bile, in which as much as 25 grammes of bicarbonate of sodium were introduced into the stomach of the dog, Glass reached the following conclusions:

1. Alkalies taken by the mouth or introduced into the stomach do not appear in the bile.

2. The normal alkalinity of the bile is not increased by taking alkaline salts.

3. The relative percentage of the sodium and potassium salts in bile is constant. The exhibition of large doses of the salts of one or the other metal produces no corresponding increase in the bile.

4. There is absolutely no cholagogue action observed from any of the sodium salts.

Yet, in the face of these experiments, there is no practitioner to-day who does not, at times, feel that the exhibition of sodium salts, or the use of alkaline waters, is of incalculable benefit in the treatment of hepatic disorders; and the well-earned reputation of Carlsbad, Marienbad, Vichy, and other mineral springs, emphasizes most strongly the discrepancy between the laboratory test and clinical experience.

In judging of the effects of cholagogue drugs we are liable to err from another source. Stadelmann has shown that many wrong inferences have been drawn from variations in the quantity of bile, such variations being really physiological, and occurring without the intervention of medicine, from day to day. This diurnal fluctuation may amount to as much as from 20 to 30 per cent., and, taking an hourly standard, may in the course of two hours vary from 60 to 100 per cent. In Hammarsten's case of cicatricial stenosis of the common duct with subsequent fistula, the whole quantity in twenty-four hours varied from 200 to 600 c.cm. In Korte's case, where the common duct was open, the quantity passing into the bowel varied from 200 to 1200 c.cm.

As a result of his own experiments Stadelmann finds that a large quantity of water given by the mouth has no effect on the secretion of bile.

Of other agents investigated, he makes four classes:

1. *Having no cholagogue action.*

(*a*) Alkaline salts. Bicarbonate of sodium, chloride of sodium, sulphate of sodium, acetate of potassium, sulphate of magnesium, bicarbonate of potassium, tartrate, sulphate, and citrate of potassium. In large doses most of them diminished the secretion of bile.

(*b*) Purgatives and drastics. Gamboge, gamboge and soda, jalap (tuber and resin), convolvulin, soda salts of convolvulin, jalapin, jalapinate of soda, aloes, rhubarb, cathartinic acid, podophyllin, podophyllotoxin, senna, scammony, different soaps. Calomel showed no chologogue action, the bile being at times increased, unchanged, or diminished. After profuse diarrhœa the secretion of the bile was not lessened; after moderate diarrhœa, considerably so.

(*c*) Various remedies, such as alcohol and olive oil. These produced a diminution rather than an increase.

2. *Lessening the secretion of bile.* Pilocarpine and atropine.

3. *Possessing doubtful cholagogue action.* Antipyrin, antifebrin, caffeine, benzoate of caffeine, diuretin, santonin, Durand's remedy (which owes any efficiency it may possess to the turpentine contained). For each of these the cholagogue action is slight.

4. *Remedies with pronounced cholagogue action.* Salicylic acid in moderate doses. A dose of 3 grammes in dogs weighing 20 kilogrammes produced an increase often reaching 60 to 70 per cent. and lasting for twenty-four hours. At the end of the twenty-four hours there were decided symptoms of salicylic acid poisoning, dyspnœa and great unrest. Sodium salicylate, though not always uniform in its action, is a powerful cholagogue. The surest and most powerful cholagogue is the bile itself, especially the bile-salts. The administration of 4 or 5 grammes of the bile-acids results occasionally in an increase of 100 per cent., lasting twenty-four hours. If the dose is given twice daily, the increase amounts to 120 per cent. This dose is borne without injury. The greater the dose, the greater the secretion, both liquids and solids being increased. The greater part of the bile-acids administered is again excreted from the liver, both the bile-acids of the animal proper and the bile-acids of different animals when so used. After the use of salicylate of soda only the watery portions of the bile are increased, not the bile-acids. If we use the acids of beef bile for experimenting on the dog, the biliary secretion of the latter becomes green, and contains glycocholic acid, not normally found in dog's bile.

With regard to cholagogue drugs, it may be said that but few have

an action limited to the liver alone. It is true that we may influence the various functions of the liver by drugs; thus we have secretory cholagogues, by which the quantity of bile furnished would seem to be increased; excretory cholagogues, which do not stimulate the activity of the liver, but cause rapid expulsion of the bile from the intestine, thus preventing its resorption; the glycogenic function may be increased, as by the use of antipyretics or by bicarbonate of soda; while poisons that cause degeneration of liver-cells, such as phosphorus, arsenic, and antimony, diminish the glycogenic function to such a degree that animals poisoned by arsenic show no glycosuria after irritation of the fourth ventricle.

In the management of liver diseases, however, it often becomes necessary to address the remedy, not so much to any one function, as to the nature of the diseased process; as, for instance, in cases of malarial enlargement, of syphilis, amyloid degeneration, etc. The restoration of normal function is to be effected by the arrest of the diseased process, after which the liver may regenerate itself.

Many of the diseases connected with the liver are, primarily or secondarily, diseases of the gall-ducts. In order that remedial agents should prove effective here they must be eliminated with the bile, and thus exert a local action in passing from the liver. Very few, however, are the medicines which take this channel for elimination; the list of Chauffard embraces bile, turpentine, terpine, terpinol, rhubarb, salicylic acid, bromide of potassium, chlorate of potassium, iodide of potassium, and arsenic. Elimination of drugs through the liver takes place quickly. Lafter found that rhubarb, injected into the duodenum, appeared in the bile, in small quantities, after five minutes. Inasmuch as many of the diseased conditions of the bile-passages are associated with or dependent upon the entry of micro-organisms, that remedy should be selected which can best secure biliary antisepsis. For this purpose salol seems to answer most admirably. Its decomposition in the intestine into salicylic and carbolic acid promotes intestinal antisepsis, and allows of the prompt absorption of salicylic acid without the gastric disturbance likely to follow the direct exhibition of the acid; the drug can be used for a long time, as it is speedily eliminated.

Let us recur in general terms to the matter of diet. No single feature in the management of all hepatic affections, save only the acute inflammatory processes, is of so much importance as the strict regulation of the diet; none so difficult. The insufficiency of the liver-cells to functionate properly calls for the immediate withdrawal of all sources of irritation, of all substances stimulating the glandular activity in any form, or of those depending in a measure, for digestion and assimilation, upon the chemical properties of bile.

Alcoholic drinks, of all kinds, must be withheld absolutely. I have not been able to reconcile this general law with the advice of some authors to give whiskey for the relief of weakness in chronic liver disorders. There should be no departure from this rule, unless the physician is willing to wholly abandon his endeavor. Medication is manifestly futile where the cause of the disease is allowed to continue its action. In conditions seemingly desperate, the permission to drink implies the physician's consent to hasten the decline.

Fatty foods should be prohibited. The absence of bile from the intestine, or the reduction of its quantity, interferes with the proper saponification or absorption of fat; of that which is absorbed, some finds its way into the liver-cell, mechanically interfering with its action; the gastric disturbance, associated with nearly every form of liver disease, is likely to be aggravated if fatty food is retained in the stomach long enough to form butyric and other fatty acid compounds.

Starchy and saccharine substances must be reduced to the least quantity tolerated by the patient. Many patients are driven into open rebellion by the absolute curtailment of starches and sugars. Yet the alteration of function is doubtless connected with changes in the glycogenic process. To limit the demand made upon the diseased liver in this direction is only rational. But little bread, and no sweets, should be the rule. Green vegetables well cooked, stewed or fresh ripe fruits, nitrogenous food, and skimmed milk, buttermilk, or milk diluted with an equal quantity of effervescing alkaline water should make up the regimen, until the patient is relieved. Milk alone is the ideal diet; in practice it will be found difficult to thus restrict the patient, more particularly if the injunction as to taking active out-door exercise be faithfully followed.

A change in the entire habit of life is likely to be essential in many cases of hepatic disease. Too often the error is on the side of physical inaction. When the excess of food is added to sedentary habits, enforced or voluntary, the predisposing conditions may be regarded as well established. Under such circumstances, the regulation of the diet alone will not suffice.

Attention is also to be directed to maintaining the function of the skin. It is not assuming too much to affirm that the benefit which patients derive from the use of various thermal baths is due far more to the bath *per se* than to any medicinal effect of the dissolved mineral ingredients. The stay in the bath is rarely so prolonged that absorption through the skin can be of any value, seeing that the cutaneous covering, as a rule, resists imbibition, even after prolonged immersion.

The climatic element enters into consideration for a very large contingent of hepatic disorders, acute and chronic. This is true, in the

first instance, of those derangements developing while an individual resides in the tropics; the disease being directly due to peculiar tropical conditions. The military forces stationed in India, in Algiers, in Tonquin, in Egypt, have all suffered considerably from the operation of this cause. The disturbances to which the liver is liable are supposed by some authors to be the result of a primary over-stimulation of the hepatic cells, followed by subsequent exhaustion and lessened functional power. Change of climate is urgently indicated in these cases.

In the face of much experimental evidence to the contrary, most satisfactory results are to be obtained from a stay at some of the many saline and purgative springs. The physician has only to take the promenade at Carlsbad (Bohemia), where, following the old Greek fashion, tablets expressive of the gratitude of some of the many beneficiaries line the wall of solid rock, to become convinced of the powerful agency contained in that far-famed water. Another Hippocrates might almost construct the clinical history of the whole complex of abdominal derangements from these accumulated records.

It is not the lay mind alone which grows enthusiastic in view of the results achieved. The following remarks by Sir Joseph Fayrer, than whom none is more familiar with the peculiarities of disease in India, show that impartial critical judgment can only endorse the popular belief: "The waters [of Carlsbad] are indicated in the following disorders: In congestion and functional derangements of the liver, in catarrhal jaundice, in gall-stones or inspissated bile, and in chronic hepatic enlargements in which the serious structural changes of the amyloid or other degenerative processes have not taken place; in chronic engorgement of the portal system, in catarrhal conditions of the mucous membranes of the intestines and congestion of the hæmorrhoidal vessels, also in habitual constipation, incipient hæmorrhoids, and even in the earlier stages of tropical diarrhœa; in diseases of the spleen, such as chronic hyperæmia, and enlargement resulting from malarial poisoning; in chronic gastric catarrh, in cardialgia or gastralgia, dyspepsia, dilatation of the stomach; in those forms of albuminuria which take place as the result of abdominal plethora, and changes in the blood due to malarial poisoning; in renal and vesical gravel; in lithiasis; also in chronic catarrh of the bladder and hyperæmia of the prostate gland, and in some hyperæmic conditions of the uterus and its appendages; in all conditions in which the gouty diathesis manifests itself, and in general abdominal plethora and in obesity, whether of the abdomen or of the body generally. In the earlier stages of diabetes there seems little doubt, from the testimony of eminent authorities, that benefit may be derived. But Carlsbad is to be especially recommended to those who, after protracted

residence in India or other malarial climates, suffer from occasional recurrences of malarial fever, with consequent derangement of function and even alteration in the normal condition of the liver, spleen, and other abdominal viscera; who, without suffering from any positive disease, are failing in health, have impaired digestion, or distended condition of the abdomen, increasing fatty deposit in the omentum, and a tendency to fatty degeneration of the muscular system generally; who find themselves languid and depressed, unequal to much physical or mental exertion, show indications of incipient anæmia, suffer from dyspnœa, rheumatism, or gouty pains, irregular action of the bowels, congestion of the portal system, and distended hæmorrhoidal vessels—a state of things perhaps in some cases aggravated by excesses or irregularities of diet, or the neglect of due precaution as to the quantity or kind of alcoholic stimulants. Indeed, almost every European not the subject of organic disease who has spent some time in India would do well to avail himself of the resources of Carlsbad before he enters on the new course of life which lies before him, whether he be returning to India from furlough or retiring to spend the remainder of his life at home."

Carlsbad is probably the best known and most frequented of all the springs whose waters are of value in diseases of the liver or bile-passages. Vichy in France is held in high repute, though strong testimony is given by Kocher of Berne, himself a sufferer, in favor of the superiority of the Bohemian spring. In this country the waters of Saratoga Springs in New York, of Bedford Springs in Pennsylvania, of French Lick Springs in Indiana, and of Glenwood Springs in Colorado are pre-eminently of value.

I confess to a strong prejudice in favor of Glenwood. Situated on the western slope of the Rocky Mountains, at an altitude of about 6000 feet, surrounded by scenery of indescribable grandeur, with abundant opportunity and incentive for out-door exercise, with a climate delightfully cool in summer, it would seem especially favored in its location for the class of diseases in question. The thermal waters, which issue from the rock in close proximity to the leading hotel, have a rich percentage of salt, magnesia, and sulphuretted hydrogen. The saline taste predominates and effectually covers the taste of the sulphur gas. The water can be taken very freely, just as it issues from the spring; its overflow is conducted into a large artificial swimming-pool, built in the open air, where the bath can be enjoyed, the water having much the same buoyancy as would be felt if bathing in warm ocean baths. The natural heat of the water is tempered by the addition of cold spring water from the mountains. With some ingenuity other hot springs have been utilized for the creation of a cave bath, like the old Roman baths,

vestiges of which are found in the volcanic country about Naples. Some blasting, with the addition of a limited amount of masonry, has furnished spaces saturated with moist hot vapors, in which the skin is promptly stimulated to its greatest functional activity.

ACUTE HEPATITIS.

Under this term may be classed two varieties of diseased processes. The first, usually the result of excesses in diet or drink, is traceable, as a rule, to a recent indiscretion; is usually of very brief duration; the distribution of the process is general as affects the gland; and the changes, sometimes described under the head of "active congestion," are largely due to the increased afflux of blood. The typical examples of this disorder are found in persons who have "gone on a spree," taking little if any food and drinking to excess for many days in succession.

The treatment which has proved most effectual in my observation has consisted of lavage of the stomach, for the accompanying gastric catarrh—an invariable feature—the immediate administration of ten grains of the mercurial pill, followed the next morning by a free dose of salts, and a milk diet, with rest in bed. The pain in the hypochondrium is rarely acute, being rather a sense of heaviness and unpleasant distention than actual pain. Dry cups, sinapisms, or two or three small blisters, one inch square, may be applied externally. The disappearance of the hepatic enlargement can often be followed from day to day by careful physical examination. In the period of convalescence the diet should consist largely of milk, green vegetables, and lean meats. Water may be taken freely; when the stomach recovers slowly, hot water will be better tolerated and exert a better effect than iced drinks. After the preliminary purgation, the bowels should be kept open by a vegetable purgative, aloes, rhubarb, cascara or senna. As a stimulant to the impaired gastro-intestinal function, as also to the nervous system, tincture of nux vomica in 10-drop doses, after each meal, will prove satisfactory.

In the second class of cases the inflammation is circumscribed in distribution; the symptoms, though acute, are evolved more gradually; there is no direct connection between intemperance and the occurrence of the liver disease; and the treatment, to be effective, must be surgical rather than medical. This affection is generally known as—

Hepatic Abscess.

This is a localized acute hepatitis resulting in the formation of pus, and is most commonly metastatic in character, as secondary to diarrhœa or dysentery; some cases are traumatic; some are undoubtedly not

due to transportation of infectious material, as they contain a sterile pus. The treatment of this affection should be purely surgical; yet in every instance, except in military practice, it is the physician who is first consulted. The question of when to interfere surgically, what operation offers the best chance, and what promise of success may be held out to the patient, constitutes a legitimate field of inquiry.

The question of etiology enters into consideration for a much smaller part than might be imagined; for, whether the abscess be due to hepatic infection by the bacillus coli, the diploccocus, the tubercle bacillus, the amœba coli, the streptococcus citreus, the streptococcus pyogenes aureus, the bacillus pyocyaneus, the breaking down of an echinococcus cyst, or to suppuration communicated from calculous cholecystitis, the treatment is in all cases the same. It is not, therefore, necessary to make many classifications.

The possible recovery of the patient will depend less upon the etiological factor than upon two features of the disease: 1. The length of time intervening between the formation of the abscess and its recognition by the physician; 2. The promptness with which, after its recognition, a free exit is secured for the pus by an opening communicating externally. The longer the interval during which pus is unrecognized, the greater is the danger of the development of multiple abscesses—an occurrence that adds greatly to the gravity of the situation. Ferron reports 47 cases of liver-abscess submitted to operation, in 39 of which the abscess was single; of these only 1 died. In the remaining 8 cases there were multiple abscesses; 5 died.

The technique of the operation for hepatic abscess has been considerably improved in the last few years. I have, therefore, collected from accessible journals 101 cases, occurring since 1891, from which some statistics bearing upon prognosis and treatment may be deduced. Not all of these cases were submitted to operation. In some the proffered help was refused; in others the situation was too desperate to admit of operation; while in a third class the propriety of operation seems not to have suggested itself to the attending physician. In a considerable number there would seem to have been inexplicable and unwarrantable delay after the diagnosis and location of the abscess were no longer in doubt; thus, in my list there is one case of a woman, aged fifty, from whom, at the first aspiration, there were withdrawn two quarts of pus. Two weeks later a second aspiration removed two gallons; three weeks later a third aspiration drew off another two gallons. The following week, as there was evidence of re-accumulation, a trocar was inserted, and left *in situ*, and healing finally took place. An immediate incision at or shortly after the first operation would have ensured a more speedily recovery and saved the patient from possible danger of multiple abscesses.

As a result of the tabulation of these 101 cases, there seems to be no reason to doubt that the earliest operation, securing free drainage and easy escape of pus, is the best for the patient. As Irish has remarked, the danger of liver-abscess depends, not upon the operation, but upon the extent of the pus-cavity, and the relative amount of liver-tissue destroyed before operation.

Of the 101 cases, 83 occurred in male subjects, with 33 deaths—mortality 39.76 per cent.; 18 cases occurred in females, with 10 deaths—mortality 55.5 per cent.

Of the 43 fatal cases, the abscesses were multiple in 24, single in 9, not stated in 10.

Of the 9 fatal cases in which the abscess was single, in one it burst through the lung and the patient died of exhaustion.

One case occurred in a child of five. The patient was an Egyptian child, who suffered from dysentery. An operation gave prompt relief. There was a relapse of the dysentery three months later, and a second abscess formed in the other lobe. Operation was refused. The abscess finally ruptured into the colon. The patient died from hectic fever and a secondary brain-abscess.

One was a suppurating hydatid cyst, in which aspiration was made three weeks after the onset of the symptoms; after which, operation was delayed for another week. Death followed in a week from the time of the operation.

One was a suppurating hydatid that opened through the lung. The patient suddenly began to cough and expectorated fœtid pus and died in two days.

One abscess had before operation broken into the cellular tissue behind the kidney and colon, so that the right kidney lay free in the abscess-cavity. The aspiration was made two months after the onset of symptoms, and a free incision was practised the following day. Death occurred on the day of operation.

In one case the aspiration was made six weeks after the first appearance of the symptoms; then, after waiting a week, an incision was made; death occurred in forty-eight hours, from exhaustion.

In one case, occurring in a man of sixty, the abscess extended to the pelvis; the operation was performed late; death ensued from exhaustion.

In one case the abscess occupied the convexity of the liver; tentative aspiration, performed repeatedly, was unsuccessful in locating the pus. The patient died without operation.

In one case rupture had occurred into the peritoneum. A laparotomy was made, but too late to be of service. The patient died in a short time.

In no case of single abscess could death be in any way attributed to the operation.

Of the 101 cases, 24 are given as multiple : 2 of these died without operation, 22 were operated upon, of whom 20 died, the time of survival varying from five hours to three weeks after operation. Of the two cases which recovered, one was a child aged three and a half months, which developed two abscesses in the left lobe and one in the right ; each of these was incised, and dressed with gauze, and the recovery was rapid. The origin of the abscess was supposed to be infection from the umbilical vessels. In the other case, that of an old soldier, aged forty-eight, who had had chronic diarrhœa and dysentery, aspirations were made every five days for six weeks, then an incision followed. The abscess-cavity was opened, and allowed the examining finger to break into two adjoining abscesses, so that virtually the case was one of single abscess immediately after operation.

Of 24, given as single abscesses, other than fatal cases already cited, operation was performed in 20, all making a good recovery.

Of 28 additional cases, where the number of abscesses is not given, though a single one may be presumed to have existed as there was but a single operation, 24 recovered, and 4 died—one from dysentery, one from diarrhœa, one quite suddenly during irrigation, two weeks after operation, and one from hæmorrhage excited by irrigation, a week after operation.

Ten cases were treated by aspiration alone ; 5 recovered and 5 died. Of the 5 cases which recovered, one was traumatic, following a kick from a horse ; a teacupful of pus was withdrawn three weeks after the injury ; in another a teaspoonful of pus was withdrawn, there were no further symptoms ; one case was irrigated through a trocar left *in situ*, one had trocar left, without irrigation, and the last was much improved after a single aspiration. Of the 5 deaths following aspiration, two were due to the failure to find the pus, two occurred after repeated aspirations, no attempt at incision having been made, and one was due to chronic dysentery.

Aspiration alone gives a mortality of 50 per cent. Operation in all cases, including multiple abscesses, has a mortality of 34 per cent. ; in single abscess the mortality after operation is less than 8 per cent.

In nearly every case aspiration was performed as a preliminary step to further operation, without appearing to have prejudiced the subsequent course of the case. Reeve has reported fatal hæmorrhage from wounding of a large vessel by the needle during insertion—a possibility to be remembered in connection with Harley's suggestion of bleeding the congested liver by repeated withdrawals of blood by aspiration.

To avoid the graver surgical operation, while securing some of the

benefits of drainage, Manson has proposed to carry through the canula an over-stretched rubber tube of larger calibre than the canula. As the canula is withdrawn, the tube resumes its normal calibre, effectually preventing any leakage into the abdomen. Through the tube irrigation can be performed, if desired.

In operating it is scarcely necessary to wait for adhesions to form between the liver and the abdominal wall, nor to make the operation in two sittings, as the liver can be stitched to the abdominal parietes before being incised. When the abscess occupies the convexity of the right lobe, the transpleural incision with resection of the ribs offers the best chance for recovery.

The surgical procedure of the day will scarcely justify Little's proposal, of plunging the bistoury directly through the abdominal wall into the abscess-cavity regardless of the existence of adhesions. The liver should be carefully exposed, and, when not adherent, united to the edges of the wound by sutures before the abscess is opened.

At the preliminary aspiration the character of the pus should be carefully examined and cultures made, if possible. The pus may be absolutely sterile, as in a case of Tuffier's, following calculous cholecystitis. Following the evacuation, the calculi, four in number, were withdrawn ; the fourth slipped from the fingers and fell into the peritoneal cavity, and was found only after prolonged search. Some pus escaped during this time ; there was no reaction ; the recovery followed promptly. In another case the abscess burst directly into the peritoneum. A laparotomy was made, drainage secured, and the patient recovered.

The discovery of the tubercle bacillus in the pus from the abscess does not preclude recovery. In Robson's case the patient, who had been ill for a year, was treated by free incision, rubbing in iodoform, and drainage. Tubercle bacilli were found in the pus, though no other tubercular deposit could be found in the body. The patient made a complete recovery. This case is unique.

Where amœbæ are present, they may not be found by aspiration nor in the pus first discharged after evacuation, as they tend to adhere to the abscess-walls, rather than to occupy the cavity. The pus in these cases is very viscid. One or two irrigations with a solution of quinine 1 : 1000 have, in a reported case, caused the disappearance of the amœbæ and hastened recovery.

Most extraordinary parasites have been found inhabiting the pus. Grimm reports the case of a gardener's wife, who had an abscess, followed by pulmonary abscess. The liver-abscess was opened and drained. Pus from the liver, as well as the sputum, contained most curious flagellated protozoa, of which illustrations are given in the

original report. Burch reports a similar case, without pulmonary involvement. The mode of entry of the protozoa is unknown.

The dangers after operation are persistent vomiting, intractable diarrhœa, and the presence of other abscesses. No special rules apply to either the vomiting or diarrhœa, both due to sepsis. Hypodermic administration of a combination of morphine gr. $\frac{1}{4}$, atropine gr. $\frac{1}{150}$, hyoscine gr. $\frac{1}{100}$, has been of benefit. Rectal alimentation is scarcely indicated, as the bowel is not in the best condition for absorption. When the stomach is tolerant, and stimulation is required, champagne in small quantities is advantageous.

Early operation is the best safeguard against the development of asthenia at later periods. Age is no contraindication for operation. Two patients in my tables were under six months of age; both recovered. The oldest patient was a man aged sixty-three, who had passed through an attack of chronic dysentery. Recovery after operation was prompt.

Recuperative power in some cases is little short of marvellous. Wysman and Grappeling report the history of a man who, at the age of thirty-one, while living in India, had an abscess of the liver which opened through the lung. At the age of forty-three a second abscess opened into the intestine, and finally healed. They saw the man at the age of forty-five in Java. The third abscess of the liver now occupied the left lobe. He was seen in the out-door clinic of the hospital, and was aspirated, a pint of pus being withdrawn. After a few hours the patient insisted on returning to his home in the country on horseback. He returned in two weeks, the abscess was incised, drained, and recovery ensued.

Absolutely hopeless from the start are the cases of the so-called areolar abscess, in which the whole substance of the liver is permeated with streams of pus, so that on section it would almost seem as though a large sponge, with small meshes, had been filled with a thick purulent fluid. Such cases are very rare, only one being reported in my collection.

CHRONIC INTERSTITIAL HEPATITIS.

Under this head will be considered only that variety of chronic inflammatory change attended by increased hardness, new formation of connective tissue, atrophy of liver-cells, and diminished size of the liver which is not malarial or syphilitic in its origin. In both of these diseases changes take place similar in their ultimate effects to those of cirrhosis. The treatment for the causal condition, whether syphilis or malaria, will stay the process, and, in earlier periods of these diseases, permit of a restoration of function and structure.

The treatment of cirrhosis is concerned partly with the changes in the liver itself, but often more prominently with secondary symptoms due to the obstructed circulation through the portal distribution. The relief of these conditions calls for prompt interference, on account of the direct menace to life which they entail.

In recognition of the prominent rôle played, in some cases, by excessive consumption of alcoholic drinks, the treatment will demand the early and complete withdrawal of spirituous liquors; cirrhosis seems rarely to follow in the wake of excesses with malt drinks in adults. Aside from the consumption of spirits, occupation seems concerned in determining the incidence of the disease. Alison found that, in field laborers, the proportion of those drinking freely who suffered from cirrhosis was as 1 : 85; in those living in cities, who led active lives, as 1 : 42; while in city residents with sedentary pursuits it rose to 1 : 25. This statement is corroborated by the observations of Rosenstein of Leyden, who says that the industrious inhabitants of the Low Countries are very liberal consumers of ardent spirits, yet cirrhosis of the liver is a clinical rarity.

When it is possible for the individual to change his vocation, a more active life is to be counselled. This is the more imperative where primary tuberculosis is followed by secondary cirrhosis. Clinically this has been observed; and Brieger's experiments on guinea-pigs and rabbits showed cirrhosis very commonly after inoculations of tuberculosis.

Spontaneous cure of cirrhosis is not unknown. Frémont cites two instances. Many cases, too, come to autopsy in which, during life, no symptoms existed; yet the characteristic lesions appear in the liver. Duke reports a case of spontaneous cure by adhesions forming with the abdominal wall, with free anastomosis of the vessels. The portal congestion found relief in this way, and the symptoms rapidly disappeared. Morrison had previously operated to secure this result by making paracentesis, drying the anterior surface of the liver with antiseptic gauze, and then stitching it to the anterior abdominal wall, the latter having undergone a similar drying. The result was very satisfactory. Fagge, in 130 cases of cirrhosis, observed post-mortem at Guy's Hospital, found 43 where it was recognized only after death.

The object of the *treatment* in every case should be to enable the liver-cells not yet affected to carry on their function without embarrassment, to relieve the portal congestion, and to establish the collateral circulation. In meeting the first indication we are again confronted with the question of diet. Some lessening of functional power must have occurred before the patient applies for treatment; the tissue remaining intact should not be taxed too heavily. Milk diet is of very great value. All observers—French, Italian, English,

and German—agree upon this point. It commends itself by its easy assimilation, by its freedom from principles likely to lead to intestinal ptomaïnes, and by a certain diuretic action, which Lancereaux in particular claims to have observed. Highly seasoned food must be avoided, and meat or albuminous food should not be taken oftener than once daily.

The second indication calls for active exercise, the maintenance of the functions of the bowel, avoiding the use of constricting bands or clothing about the waist or abdomen, and limiting the quantity of fluid absorbed from the intestine. Drastic purgatives have also been employed; the objection to their use is found in the proneness to diarrhœa which often exists, and which sometimes demands treatment for its control.

The collateral circulation is promoted by the use of hot baths, warm compresses over the abdomen, poultices, massage, or by the establishment of adhesions. The gastric symptoms are likely to be prominent early in the disease. Nausea, loss of appetite, and occasional vomiting will often yield to milk diet alone. In the later periods vomiting is not so common, unless it be in the form of hæmatemesis.

Iodide of potassium has been highly recommended. Its efficacy seems to be restricted to those cases in which the lesion must be considered syphilitic in its origin. History of infection is not always clear; yet the iodide is not to be employed for any length of time, to the exclusion of other remedies. Should the case be one of syphilitic cirrhosis, the benefits of treatment with the iodide will speedily manifest themselves. Cases in which syphilis can be absolutely excluded need not be subjected to this treatment: time will be lost, and disappointment will follow its use. As Chauffard says, it is more potent for evil than for good.

The most common symptom causing distress is ascites. For its relief there may be given internally calomel, balsam of copaiba, acetate of potassium, salicylate of caffein, diuretin, bitartrate of potassium, and urea. There seems to be great unanimity of opinion that diuretics are vastly better than cathartics for the relief of the dropsical accumulation. With the establishment of diuresis not only the ascites but other symptoms are promptly improved. Calomel has many warm supporters; Palma goes so far as to say that if improvement does not follow its use in a case of cirrhosis, where ascites exists, the case is hopeless; if it helps, there is prompt diuresis and rapid relief. It never has any bad effect on the kidneys; and, if it should provoke diarrhœa, this is easily checked by tincture of opium. Of six cases of ascites complicating liver trouble the result in four treated by calomel was very beneficial; the quantity of urine was increased from three to ten times.

While calomel is being given, the use of mineral waters or of mineral acids should be discontinued, nor should salt be taken in any quantity at or near the time of its administration; as experiment has shown that bichloride is thus readily formed. Calomel may be administered in several ways. However administered, strict buccal antisepsis should be maintained by frequent rinsing with chlorate of potassium solution. Bouchard gives daily doses of from $\frac{1}{4}$ to 1 grain, continued for a considerable time.

The method of Saccharjin, endorsed by Palma, Sior, and others, is to give doses of $\frac{3}{4}$ grain six times a day for three days, then stop for three days, repeating the procedure until the patient is relieved. Palma has used larger doses, giving 3 grains three times a day for three days, then pausing for three days, and so on; or, the quantity may be reduced from an initial daily amount of 15 grains to 6 grains or less, always observing the rule that, following three days of treatment, there shall be three days of rest. My own experience with Saccharjin's plan, limited to three cases, has impressed me with its value. The manner of its action is not quite evident. Chauffard says that it acts not only as a purgative and diuretic, but also seems to have some effect in modifying the function and nutrition of the liver; perhaps has some effect even on the sclerotic tissue.

Acetate of potassium enjoys considerable favor in England, and is also recommended by Rosenstein and others. Sasaki has lately called attention to the use of cream of tartar in large doses, from 2 drachms to $1\frac{1}{2}$ ounces per day, the quantity averaging from $2\frac{1}{2}$ to 5 drachms. The patient has two or three stools daily. Ascites rapidly disappears; in some cases the relief is permanent. In 12 cases the remedy acted well. In addition, he advises iron, quinine, and light, nourishing diet. Diuretin can be given in daily amounts of from 40 to 60 grains.

Urea has been introduced in the treatment by Klemperer. Its main value is as a diuretic. Klemperer has not had as pronounced results from tapping as some authors; he treats recent cases by digitalis and calomel. When calomel produces bad effects, this author has seen great benefit from the use of urea. He gives 10 grains per diem, increasing the quantity to 15 or 20 grains, and continues its use for two or three weeks. He has never seen any unpleasant results. Its disagreeable taste is covered by giving milk immediately thereafter. Two cases are detailed. The diuretic effect in both was marked; in one case the secretion increased from 250 c.cm. for the day to 4000 c.cm.; in the other from 600 to 5000 c.cm. The abdominal measurement decreased from 106 to 86 cm. in the one, and from 97 to 82 cm. in the other. Ascites disappeared immediately in the first case, and never became troublesome again in the other. Klemperer recommends it strongly.

In every case of ascites the question of tapping requires consideration. There can be no reason for delay; there is every reason for its prompt employment. The accumulated fluid may or may not interfere with the kidney-function by pressure on the renal vessels; it will at least distend the abdomen, destroy the retaining tonicity of the abdominal wall, interfere with respiration, and, as recent experience has shown, it seems to act as a predisposing cause to the development of tubercular peritonitis or of chronic peritonitis. Ebstein has lately insisted on this point. Forster found 3 cases of tubercular peritonitis out of 31 autopsies in cases of cirrhosis, and Wagner saw 10 such cases. Additional argument is to be found in the fact that a single tapping sometimes seems to prevent any re-accumulation.

Carried out with antiseptic precautions, and with the measures described by Professor Musser (Vol. II.) to give support to the abdomen as the fluid is withdrawn, the operation is wholly devoid of danger. The large amount of fluids withdrawn at a single tapping seems to disturb the economy but little, and the system rallies quickly; nor is there any harm in its frequent repetition. A case is reported which was tapped and aspirated, in all, upward of three hundred times. Early and frequent tapping should be the rule.

Hæmorrhages sometimes call for treatment. The hæmorrhages may come from the bowels, stomach, or œsophagus. The venous distention becomes great enough to produce vascular dilatations, which finally rupture. Hæmorrhage may be the direct cause of death. It is usually very severe. Ergotin is not to be commended. Absolute rest, ice internally, and morphine are more to be depended upon. Diarrhœa can generally be controlled by means of salol, opium, and the salicylate or subnitrate of bismuth.

HYPERTROPHIC CIRRHOSIS OR HYPERTROPHIC CIRRHOSIS WITH JAUNDICE.

This has until recently been considered as essentially an incurable affection. Owing to the great rarity of the disease, no single individual is likely to accumulate much experience regarding it. Sior, following Saccharjin, has reported one case greatly benefited by calomel, after Carlsbad salts and iodide of potassium had failed. The remedy was given in 1-grain doses six times a day, for three days, then three days' pause. At the end of two months there was marked improvement.

As these cases are not dependent on an alcoholic cause, the injunction as to total abstinence might lose some of its force, were it not that alcohol would only prove an added source of irritation to the impaired gland. Diet should be simple, concentrated, and not stimu-

lating. Hæmorrhages are exceedingly common in this disorder; but the hæmorrhages are, as a rule, from mucous surfaces not connected with the portal circulation; their treatment is local. Tonics are to be given after bleeding is arrested. No remedy has been found to exercise any control over the curious nervous disturbances which develop in the late stages.

Mention may here be made of the very singular form of hypertrophic cirrhosis described by Ghose and Mackenzie as occurring in India, in the young children of native parents, the victims being mostly under one year of age, rarely over five. The pathology of the affection is wholly unknown, but the lesions are well described in the original communications. No treatment was found to be of any avail; the patients soon succumbed to the disease. Of 500 cases only 6 recovered. Well-fed children suffered more than those of the poorer classes, and often many children in one family were affected.

The pigmentary cirrhosis of diabetes, the malarial cirrhosis, the cirrhotic changes associated with venous stasis, and the cyanotic induration of heart disease, demand treatment of the causal conditions, and call for no special measures directed to the liver itself.

In chronic malarial enlargement no reduction of size is likely to follow the final extinction of the plasmodia. I have under my care a patient, whose liver reaches almost to the umbilicus, as a result of chronic malaria acquired during the war, more than thirty years ago. Aside from an uncomfortable distention, no particular inconvenience is felt; the size of the organ has not undergone any appreciable change. Acute malarial enlargements are sometimes met with, affecting the organ as a whole, or, as in a case of my own, limited to one lobe, and then simulating hepatic abscess. In this case, the free use of quinine and rest in bed caused the liver to return to its normal size inside of three weeks, though the enlargement had carried the border of the right lobe to within a half-inch of the umbilicus. In malarial cases, quinine, arsenic, and iron are sovereign remedies.

PASSIVE HEPATIC CONGESTION OR NUTMEG LIVER.

This symptom of impeded circulation through the right heart, whether as a consequence of tricuspid disease, obstruction in the lungs, or as the last stage in failing compensation of valvular disease of the left side, calls for no independent treatment. The remedies that will sustain the cardiac force and open up the peripheral arteries will overcome the venous congestion of the liver. Alcohol should not be employed. Digitalis, nitro-glycerin, strophanthus, strychnine, and caffeine can be given with advantage. When there is much pain

and fulness in the right hypochondrium, a single free purgation will often give relief, especially if combined with milk diet. Dry or wet cups act quickly and well. Repeated doses of drastic purgatives or of calomel may be tried, when symptoms do not yield promptly.

ACUTE YELLOW ATROPHY.

MANY features of this affection suggest a close analogy with infectious diseases. It is so classed by Babès, who believes that in every case not due to toxic causes, as phosphorus, antimony, etc., there is an invasion of micro-organisms. He recounts four cases of which two died with symptoms of a fulminant hæmorrhagic septicæmia; the third case ran a less acute course, the fourth revealed at autopsy many streptococci in the portal vein, though the liver contained none. Cases occur at all periods of life, but treatment seems futile alike in all. Hæmorrhages can in part be controlled by mineral acids and atropine. During the periods of excitement, sometimes approaching mania, morphine will render good service; when collapse is impending, stimulants, may postpone the inevitably fatal issue.

AMYLOID LIVER.

THE treatment of amyloid fever is the treatment of its cause. The indications are to arrest the suppurative process, remove caseous deposits in bone, treat an existing syphilis, or to give arsenic and quinine for obstinate malaria. To these may be added general tonics.

SYPHILIS OF THE LIVER.

THE treatment of syphilis of the liver is essentially the same, under whichever form it may manifest itself. The manifestations are more various than has been generally believed. It is necessary to include congenital syphilis of the liver itself and of the biliary ducts, gummatous growths, sessile and pedunculated, and the early jaundice and acute yellow atrophy which Senator recently described. The jaundice appears in the earlier period and apparently runs the course of simple catarrhal jaundice. It is, however, very intractable to treatment, and only yields to anti-syphilitic medication. It is supposed to arise from pressure of enlarged glands on the excretory ducts, or from a possible swelling of the mucous membrane of the ducts in consequence of syphilitic infiltration; a lesion similar to the swelling of the buccal mucosa. Syphilitic yellow atrophy runs the usual course. Prior to Senator's report only seven cases had been recorded. He adds two of his own, one of which recovered. In seven of the total number of nine cases,

the patients were young girls. The virus in them seemed to manifest unusual malignancy.

As a congenital affection syphilis acquires great importance from the frequency with which it produces total obliteration or complete obstruction of the bile-ducts; the singular feature of such cases is that life should, none the less, be prolonged for six or seven months. The lesion has usually resulted in cicatrization before birth. Yet the treatment should not be omitted on that account. Mercury may be administered by means of daily inunctions or in the form of the gray powder. Congenital syphilitic cirrhosis of the liver has been found by Marchand, the fœtus being stillborn at seven months.

In the later periods of the disease in adults, the liver frequently undergoes enlargement, followed by subsequent shrinkage, counterfeiting hypertrophic cirrhosis. In such cases the calomel treatment as already described will yield excellent results. Amyloid liver following syphilitic infection does not seem to be amenable to treatment in the same degree, seeing that it has been found in the bodies of those who have had continuous treatment with iodides and mercury for considerable periods.

HYDATID CYST—ECHINOCOCCUS OF THE LIVER.

THE treatment of hydatid cyst will depend upon the variety of hydatid formation and the character of the cyst-contents. Simple echinococcus can be cured by measures that will prove of no avail in the alveolar variety, and much will depend upon the presence or absence of pus within the sac. Of the alveolar variety, that form in which successive invasion of the healthy liver takes place by the growth of daughter-cysts at the periphery, only one case of recovery has been reported, that of Brenner. Recognizing the nature of the trouble during an operation, he scraped and curetted thoroughly the walls of the sac, and then touched the base everywhere with the thermo-cautery. Hæmorrhage was surprisingly slight. The patient made a rapid recovery.

For the treatment of simple hydatids, aspiration will suffice in many cases. According to Dieulafoy, two-thirds of all cases can thus be cured. Recovery may be hoped for, though the tumor be of very large size. It is particularly in echinococcus of the liver that its healthy portion undergoes sufficient proliferation to compensate for the tissue destroyed. As the cyst usually occupies the right lobe, it is the left which is hypertrophied from proliferation of liver-cells, bile-capillaries, and connective tissue. Dürig, in the Pathological Institute of Munich, and Ponfick have remarked the extraordinary power of proliferation in liver-cells.

In making the aspiration, a fine long needle thoroughly sterilized should be employed. The danger of converting a simple hydatid cyst into an abscess of the liver should be guarded against. It is generally advised to remove all of the fluid at a single aspiration. The patient is to be kept in bed for the following twenty-four hours. Some idea as to whether the echinococcus is dead or alive may be obtained from the proportion of albumin in the liquid withdrawn. The dead sac will contain more than the living. If a single aspiration fail, it may be repeated. In one case success followed after three hundred aspirations. Re-accumulation occurs after several months, if the hydatid survives.

Should the first simple aspiration be unsuccessful in relieving the condition, the second aspiration may, with advantage, be followed by the use of some parasiticide injections, such as the solution of corrosive sublimate, 1 : 1000 (Van Swieten's liquor), tincture of iodine, supersaturated naphtholated water, iodized sulphate of copper 5 : 100. These injections are allowed to remain for ten minutes, then withdrawn, the cavity being filled with boiled water, which is again withdrawn. For a sac containing two litres it is recommended to use 36 c.cm. of the bichloride solution. Even with the best precautions toxic symptoms have followed the use of the bichloride, though it is recommended by Bacelli. Aspiration has yielded the best results in young cysts with thin walls, when the collapse of the sac could easily occur, with healing by cicatrization.

Unpleasant sequelæ have followed the operation *per se*. These accidents as given by Achard are: Sudden death from nervous influence, as in other aspirations; urticaria; sudden collapse with subnormal temperature; nausea, vomiting, and disturbance of respiration; fever running to 104° and lasting for several days; increased sensibility of the abdomen and a small rapid pulse simulating peritonitis. It is probable that these arise from the toxic products in the liquids of the hydatid cyst. The dangers increase with the size of the sac.

Should the sac be suppurating, it must be treated as any other abscess. Morris says that cases of multiple hydatid cysts are unfavorable for surgical treatment: the multiple character of the tumor is, however, only recognized at the time of the operation. Operations have been successfully performed on very young children; a case is reported in a child five and a half years old.

MALIGNANT DISEASE OF THE LIVER AND BILE-PASSAGES.

Until recently the diagnosis of cancer of the liver was equivalent to a death-warrant; life was ordinarily terminated six months after

the certain establishment of the diagnosis. Surgery has triumphantly dealt with a sufficient number of these cases to make the outlook more hopeful in the future. Keen has collected a number of cases operated upon, and comes to the conclusion that liver-tumor and large parts of the liver may be removed without impairing the function of the gland, as liver-tissue is regenerated. If the cut surface be sewed into the abdominal wound there is little danger of the escape of bile into the peritoneal cavity. Such an accident, when occurring, is not as dangerous as was once believed. The principal danger during operation is from hæmorrhage. This can be obviated by operating in two sittings, leaving an elastic ligature around the tumor after the first operation. The mortality of cases which he collected was only 10 per cent.

Primary malignant disease offers a better prognosis from operation than secondary; in the latter class, the malignant deposits are usually multiple. Primary carcinoma is comparatively rare, yet White reports ten cases from Guy's Hospital.

Hodenegg removed a primary cancer of the liver; the patient was still alive after eighteen months, seemingly in good health.

Robson operated upon a rapidly growing tumor in a woman aged fifty-four. The tumor was primary in the gall-bladder; a single secondary nodule was discovered in the liver at the time of operation, close to the gall-bladder. It was removed with the gall-bladder. The portion of the liver removed weighed half a pound. The tumors were squamous-celled epitheliomata. There was complete recovery with a rapid gain in weight. The operation was made with the elastic ligature; an incision was made around the growth, at the distance of half an inch, the ligature slipped into this and tightened, and left in place until the slough separated.

Keen's case was one of cystadenoma of the bile-ducts in a woman aged thirty-one. Recovery was effected in forty-two days.

Bergmann removed a large adenoma the size of a child's head from a man aged sixty-one. Four months after operation the patient was well.

Tiffany removed a tumor composed of liver-tissue and fine calculi from a man, who was well eighteen months after operation.

Israel extirpated a primary sarcoma from a girl aged fifteen. The base of the tumor was 15 cm. long. Removal was accomplished by thermo-cautery and the elastic ligature. The patient recovered promptly from the operation, but death followed in three and a half months from internal metastatic growths. Israel says that of 14 cases of liver-tumor operated upon only 2 terminated fatally.

Tricomi has excised the entire left lobe from a young man of twenty-three with perfect success.

Other successful operations may be mentioned:

Langenbuch extirpated a lobe of the liver. Von Eiselsberg removed a large carcinoma. Cysts of the liver have been operated upon by Lind, North, König, Terrillon.

FATTY LIVER.

Fatty liver represents, in the vast majority of cases, the accumulation in the liver-cells of unoxidized or imperfectly oxidized material for combustion. The treatment of the condition must always take account of the cause. Deficient combustion will arise from various circumstances:

1. A surplus of fatty food; prolonged use of fats as medicines (cod-liver oil, for example); or disturbances of gastric and intestinal absorption.

2. Deficient exercise, with excesses in diet and a native tendency to obesity.

3. Imperfect supply of oxygen to the liver-cells. Blood-changes may cause this, as in pernicious anæmia, chlorosis, etc.; or the chronic cachexia of wasting disease, as cancer; or mechanical difficulties in the pulmonary circulation, due to disease of the lungs or heart, favoring venous stasis.

4. Poisons which chemically affect the nutrition of the liver-cells; such poisons may be toxins of acute infectious processes, as of puerperal fever, septicæmia, pyæmia, or of malignant variola, etc.; or they may be poisons from without, as alcohol, morphine, arsenic, antimony, phosphorus, and others.

The treatment will have due regard to the cause. The best results will be obtained in the liver that is fatty from drink, from overfeeding, from too little exercise, or when there is the tendency to obesity. It is surprising to see the rapidity with which reduction of size will follow graduated exercise, and the proper limitation of both quantity and quality of food and drink. The dietary of Oertel or Ebstein may be closely adhered to; should the patient's strength permit, the process of "taking off fat" can be hastened by the systematic use of Turkish baths.

In cachectic disorders, in organic changes in the heart and lungs, in infectious diseases and disorders of the blood, no treatment need be directed to the liver.

PERIHEPATITIS.

Inflammation of the capsule of the liver and of its peritoneal investment may be either acute or chronic. The acute variety, most commonly due to trauma or impending rupture of an abscess, requires anodyne remedies and local application of heat.

The chronic variety calls for especial attention. This variety may also arise from trauma of the liver. The only case of chronic perihepatitis that has come under my care when the diagnosis could be made during life, developed as the result of irritation of the capsule by the broken ends of the fractured ribs, the patient having sustained a severe fall. The Germans have given to this condition the name of *Zuckerguss-leber*, in view of the enormous thickening of the pearly-looking capsule, which gives the gland the appearance of having been surrounded by a layer of icing, such as confectioners use to decorate their products. The process is not ordinarily attended with pain. As the thickening increases the liver enlarges, but finally diminishes in size from contraction of the new-formed tissue. As in cirrhosis, the portal vessels suffer from compression. Ascites develops comparatively early, and persists. Frequent tapping must be resorted to. Rump reports the history of a young woman, who was tapped 301 times in sixteen years; death finally ensued from exhaustion; the capsule varied in thickness from 8 to 14 mm. Palliation of symptoms due to portal obstruction, by the means already described as a feature in cirrhosis, should be attempted. Local applications of warm solutions of muriate of ammonia, kept constantly next the skin for several weeks, have been thought to be of service. The moist heat was doubtless the efficient agent here.

Subphrenic abscess and other suppurative processes originating outside of the liver scarcely call for mention here. They are surgical affections entirely, for whose occurrence the liver is rarely responsible.

As pathological conditions not amenable to treatment may be cited tuberculosis of the liver, cystic degeneration of the liver, similar to cystic degeneration of the kidneys (of which only one case has been reported), and the enlargement in Hodgkin's disease. A specimen of cystic degeneration of the liver has just come under my notice. It was found in the body of a woman, who had in addition cystic degeneration of the kidneys and ovaries.

PYEPHLEBITIS AND PYLETHROMBOSIS.

THE formation of a clot in the portal vein, with or without accompanying inflammation of the vessel-wall, produces certain symptoms of which the treatment can only be palliative. Ascites, hæmorrhages from stomach or intestines, disturbances of digestion, and the febrile symptoms dependent upon inflammation about the clot, may demand attention. Measures have already been discussed which will meet these symptoms; the cause of the trouble is not to be influenced by medicine. No remedies will dissolve the thrombus.

MOVABLE OR FLOATING LIVER; INJURIES OF THE LIVER.

For the treatment of this anomaly, surgical aid must be sought, Bolognesi says it may affect the entire organ or a single lobe. Unless the latter is distinctly pedunculated, it is not to be removed. Langenbuch has twice made hepatopexy, fixing the liver in one case to the abdominal wall, in the other to the costal cartilages. Marchant reports another successful case by fixation to the cartilages. In a boy who had tricuspid insufficiency, Leube believed the heart lesion to have caused the displacement by the constantly recurring backward wave in the hepatic veins.

Wounds of the liver and rupture of the organ occur only as the result of violence. Though formerly considered necessarily fatal, prompt intervention will save life. Micheli reported to the Surgical Congress in Rome two cases in which the liver had been wounded, where the wound in the liver was sutured, the abdomen thoroughly cleansed, and the external incision closed. Both recovered. Smits narrates the history of a Malay, so far exsanguinated that anæsthesia was not attempted. The stab-wound in the liver was closed by mattress suture, and the blood was washed out of the abdomen, which was then closed. The parts united by primary union, and the case was practically well in six days.

With regard to rupture of the liver, an important practical suggestion grows out of the case of Korbler of Dorpat. In the efforts to resuscitate a new-born asphyxiated child, Schultze's method was followed rather vigorously. The child revived, but died soon after. The autopsy revealed two tears of considerable length in the liver.

SIMPLE OR CATARRHAL JAUNDICE—CATARRHAL CHOLANGITIS.

A simple jaundice often appears in the course of an acute gastro-duodenal catarrh. The inference is that the catarrhal process has extended into the bile-passages, and the swelling of the mucous membrane has resulted in temporary obstruction of the ducts, with resorption of bile. Accordingly, the case is treated for the gastro-duodenitis—often with the happiest results. The object of the treatment is to secure, as quickly as possible, free passage for the bile.

The old, established plan consists of the free exhibition of saline purgatives and alkaline waters. Excessive purgation is to be avoided. In 1871 Krull advised dealing with cases of simple jaundice by copious injections of cold water. Every morning an enema of from two to three pints of cold water (temperature 60° F.) is given, with instructions to the patient to retain it for five or ten minutes. Usually, after

one or two attempts the patient has no difficulty, the bowel becoming tolerant; the only untoward feature may be a few colicky pains. It is claimed for the cold water that it stimulates free peristalsis, possibly as high as the inflamed duodenum, where pressure may dislodge the *materies morbi*, the offending plug of mucus, by the contractions of the upper bile-passages or of the gall-bladder. There has also been observed a distinct diuretic effect as the result of these injections. A third advantage claimed is in the regular evacuation from the bowel of toxic principles due to decomposition in the intestinal contents owing to the absence of bile. Krull's suggestion has been warmly endorsed by Chauffard and others.

Faradization of the gall-bladder, or rather of the region about it, has been proposed by Gerhardt. This is but the revival of an old suggestion, for we read that Erasmus Darwin "gave half a score of smart shocks from the coated bottle to a man who had been jaundiced for six weeks, and the same day the stools became yellow."

Massage of the gall-bladder has also been tried. The increase of pressure on the contents of the gall-bladder, due to the manipulation, would, it was hoped, force the passage and thus permit the flow of bile.

In several cases I have lately given dilute nitro-muriatic acid, with seemingly good results. The mineral acids have been used before, their employment being based on the theory that they would chemically irritate the mouth of the common duct, inducing reflex contraction. This explanation never seemed entirely adequate. In my own cases I have tested the gastric secretion during the time when the stools were clay-colored, and found hydrochloric acid either much reduced or absent. The indication for its use thus seemed clear. These observations, as far as they go, only corroborate the recognized fact of the interdependence of the digestive fluids—so that perversions of the normal processes in one gland affect in some way the quality or quantity of secretions from others.

Inasmuch as the duration of an acute attack scarcely exceeds a week, a rigid and exclusive milk diet can be maintained without much discomfort to the patient.

Not every case of simple jaundice can be classed as catarrhal; witness the instances of emotional jaundice, in which indulgence in an outburst of passion is followed by the characteristic discoloration of the skin and the absence of coloring matter in the fæces. The mechanism of this occurrence has been made more apparent by the researches of Doyen on the expulsion of the bile. The following are his results: The splanchnic major is the direct motor nerve of the bile-passages; its irritation produces contraction of the entire apparatus for expulsion of bile. The sphincter at the duodenal end

may contract so tightly as to prevent the escape of any fluid into the duodenum. Relaxation of the bile-passages is accomplished by reflex action. Irritation of the central end of the splanchnic major produces relaxation. Irritation of the central end of the vagus causes contraction of the gall-bladder with relaxation of the sphincter. Emotional jaundice is probably due to spasmodic contraction of the sphincter. For its relief, in addition to milk diet, nerve-sedatives, as bromide of sodium or valerianic ether, may be employed.

It has been recommended that patients drink freely of water, with the view of making the bile more limpid, and thus favoring its escape. The re-establishment of the flow is accompanied by a marked diuresis and a sudden increase in the proportion of urea; the total of urea for the day may reach 50 grains. The resumption of the functional activity in the liver-cells is supposed to account for this.

Cases of simple catarrhal jaundice sometimes run a chronic course, and lead to a mistaken diagnosis of permanent organic obstruction. Two instances may be cited, which will also illustrate the advantage of exploratory incision. Terrier's patient, a man aged fifty-four, entered the hospital service with a swelling of the liver, suggesting a possible hydatid cyst. Exploratory punctures were made with negative result. Jaundice supervened and became chronic. An exploratory laparotomy showed a very large congested liver, but neither cyst, tumor, nor disease of the biliary ducts. A biliary fistula was established, and, from the fifth day, the liver diminished in volume, the urine contained less pigment, and the fæces resumed their normal color. More instructive is the history of Routier's case: A man who had intense jaundice for three months, with progressive emaciation, submitted to exploratory laparotomy. There was no lesion of the liver or bile-passages, but in the course of the exploration a sort of expression of the gall-bladder necessarily occurred. Despite the apparent uselessness of the operation, jaundice disappeared in a few days, and a permanent cure resulted.

Itching of the skin in jaundice often proves the most annoying feature of the trouble. According to Potain this symptom bears no relation to the intensity of the discoloration. It appears most intensely in the palms and soles of the feet, and the entire surface may prove a source of constant torment. It is often a late symptom, and may even develop or remain after jaundice has disappeared. For its relief warm baths, washing the skin with a 2 per cent. solution of carbolic acid, or diluted vinegar, or lemon-juice, mercurial ointments, or spirituous lotions containing hydrocyanic acid, have all been recommended. An excellent application is a mixture of equal parts of sweet spirit of nitre and alcohol. Internally the bromide of sodium or of strontium, in large doses, will diminish the cutaneous sensibility.

WEIL'S DISEASE—MALIGNANT OR INFECTIOUS JAUNDICE.

THE treatment of this process, like the management of the other infectious diseases, is largely symptomatic. Properly speaking, its consideration does not belong to the study of diseases of the liver. It is generally placed there because of the prominence of the jaundice. The indications according to Chauffard are to keep the renal emunctories free, by the use of milk diet, to which may be added large rectal injections of cold water, made feebly antiseptic. Of intestinal antiseptics the best are the insoluble salicylate of naphthol, or of bismuth, salol, or benzo-naphthol in small doses, frequently repeated. The disturbance of ureogenic function calls for oxidizing agents, benzoate of sodium, oxygen inhalation, or hypodermic injections of ozonized turpentine, well diluted.

Fever may require antipyretic medication; cold sponging, an ice-cap to the head, or, if nervous symptoms are very prominent, the cold bath. When occurring in epidemic form, it is desirable to remove the patient as soon as possible to a locality with good general sanitary arrangements; to boil all drinking water, and to avoid all suspicious articles of food. After a few large doses of calomel give some simple purgative with free injections of cold water. Emetics are contraindicated. Internally muriatic acid or nitro-muriatic acid, in the form of lemonade, will be very acceptable. These are the directions given by Hensing. Severe internal hæmorrhages are to be treated by morphine, mineral acids, and turpentine. Singultus is sometimes very severe. Morphine may control it; or rectal injections of asafœtida made into emulsion with yelk of egg, 30 grains of the gum to the yelks of two eggs. Alcoholic drinks are to be avoided.

ICTERUS NEONATORUM.

THIS common disturbance scarcely calls for treatment. Usually the jaundice is transient; the trouble corrects itself. When the jaundice persists for several weeks, suspicion should be directed to a possible stenosis of the bile-ducts, depending on a hereditary syphilitic infection. Anti-syphilitic treatment is to be instituted.

SUPPURATIVE CHOLANGITIS.

THIS affection, associated as it is with a suppurative inflammation of the gall-bladder, is generally due to infection from the intestinal tract. The treatment is purely surgical; the object being, as in liver-abscess, to provide prompt and free exit for the pus and thorough drainage of the gall-bladder.

Diphtheritic cholangitis or cholecystitis occurs as an accident in acute infectious disease.

CHOLELITHIASIS—GALL-STONES.

While the question of the pathology of these concretions may be as yet unsettled, the lines of treatment have been carefully drawn, and are now accepted with little objection from any quarter. Minor details may afford ground for dispute, but the general plan of the management of these cases is endorsed by all.

Gall-stones are certainly formed more commonly in the gall-bladder than is generally believed. Bollinger states that they occur in one of every 14 persons in Central Europe; in Munich 5.4 per cent. of all persons, in Strassburg 12.3 per cent.; the difference being supposed to be due to the lessened consumption of water in Munich. For the sexes, the proportion was 3 per cent. in males, 9.8 per cent. in females.

Proper treatment has not always been instituted, because the diagnosis has been held in abeyance awaiting the appearance of the so-called cardinal symptoms, jaundice, and the presence of gall-stones in the stools. Yet these symptoms are often wanting. In a frequently cited case of Bardeleben's, the only complaint was of pain in the right side; at no time was there jaundice, and no gall-stones were passed. The gall-bladder contained 116 calculi.

The attack of biliary colic is generally the first event in the clinical history to call for treatment. After having in the course of twenty years tested all remedies, Kraus of Carlsbad says very positively there are only two remedies for the attack, morphine and chloroform. Morphine is to be given subcutaneously; where it is not well borne, or fails to give relief, then chloroform is to be administered by inhalation. This opinion is based on an experience of 2249 cases.

Harley, Stecker in Germany, and others strongly insist on the use of belladonna, in full doses, during the attack, in place of opium or its derivatives. They claim that it relieves the spasm, lessens pain, and stimulates the expulsive fibres.

Olive oil has, in the practice of some observers, seemed to possess virtues which others have failed to perceive. It is given in doses of from 6 to 8 ounces; the medication is well borne and is wholly devoid of danger. The dose may be repeated in half an hour. Villemin, Chauffard, and others attest its value. Rosenberg claims for it a powerful cholagogue action, the increase of secretion commencing thirty to forty-five minutes after the ingestion of the oil. The bile thus formed in excess is a remarkably fluid product. Olive oil may also be given *per rectum*, according to the suggestion of Fleiner; 400–500 c.cm. of pure warm oil may be given *per rectum*. A slight laxative action is thus obtained.

In place of olive oil Ferrand administers 200–300 c.cm. of glycerin with an equal quantity of chloroform water.

Where previous attacks have occurred, it is sometimes possible to determine that biliary colic is impending. Under such circumstances valerianic ether, given in capsule, is said to allay the sensibility of the ducts. Here, too, olive oil may be used with advantage. Salicylate of sodium will increase the flow of bile, act as an intestinal and biliary antiseptic, and render the bile more limpid, thus assisting materially in the expulsion of inspissated secretion, which often contains a biliary gravel. Glycerin, as suggested by Ferrand, given in doses of 15.0 to 30.0 grammes daily, dissolved in Vichy water, also renders the bile more fluid. Indeed, it is claimed that any action possessed by olive oil is due to its decomposition into glycerin and fatty acids.

Goodhart and other observers wholly deny any therapeutic virtue to olive oil. It is certain that actual expulsion of biliary calculi rarely follows its use.

The greatest importance attaches to the treatment in the interval. The formation of additional concretions can often be prevented, and actual solution of the stones seems to occur in some cases. The first object of the treatment is to relieve the gastro-intestinal catarrh, upon which the formation of the calculi primarily depends. This disturbance plays a larger rôle in the development of cholelithiasis than does inspissation of the bile, or precipitation of bile-salts from reduced alkalinity of the secretion.

The treatment of the gastro-duodenal catarrh, which extends into the bile-passages, calls for strict regulation of the diet. The smallest quantity of a mixed diet capable of maintaining the nutritive equilibrium is the proper diet for the patient. Sugars, starches, and fats should be greatly curtailed. Substances containing a notable percentage of cholesterin, such as brain and the yelk of eggs, are decidedly objectionable. The same is true of effervescing wines, malt and spirituous liquors. Green vegetables may be taken freely, as also some fresh ripe fruits, apples, cherries, peaches, and pears. The table water should not contain calcareous salts in any quantity. The meals should be frugal, taken at regular hours, and not exceed three per day. There should be regular hours for sleep and exercise.

Life in the open air, combined with active physical exercise, assists materially. The best form of physical exercise is horseback-riding. The jolting acts mechanically to empty the gall-bladder, and the general stimulus to nutrition promptly influences the gastric and intestinal catarrh. In the case of a young married lady, who suffered severely from repeated attacks following her first confinement, horseback exercise was taken daily for a year; she abstained wholly from bread and

starchy food, and has not had an attack since that time. Pürckhauer says that horseback exercise is much in vogue as a factor in the treatment of gall-stones in the West Indies. Ladies should be warned of the necessity for removing any constriction about the waist. Tight lacing is generally thought to favor the formation of biliary calculi.

Hot baths are of value. The greatest benefit, in the interval, is to be expected from a visit to one of the alkaline springs, especially Carlsbad, Marienbad, and Vichy abroad, or to Saratoga, Bedford, French Lick, or Glenwood Springs in this country. The waters of these springs appear to exercise a positive solvent action upon the stones; after taking the waters for eight or ten days many patients experience a sharp attack of biliary colic, which subsides with the expulsion of one or of several stones. Even where the cure is not immediate, a marked improvement begins; the attacks grow less severe, and occur at longer intervals. The waters give more satisfactory results if taken fresh from the springs; their use can, however, be continued at the patient's home for a long time. Rectal injections of olive oil, or glycerin taken internally, can be regularly taken during the interval. Massage and faradization can be tried.

The passage of the gall-stone into the intestines is not always easy. It may become arrested at the mouth of the gall-bladder, in the cystic or common ducts, or just beneath the papillæ of Vater, in the thickness of the intestinal wall. When it reaches the intestines the patient is not wholly free from danger. The stone, if of any size, may produce intestinal obstruction; or, if small, it may grow larger, from successive precipitation on its surface. In such an event timely laparotomy, with incision of the intestine over the impacted calculus, may save life. No great effort should be made at the time of operation to push the stone into the large intestines; the parts are liable to considerable bruising from the roughened surface of the calculus. Excision of the stone and closing of the intestine is the better procedure.

Another remote evil following the development of cholelithiasis is the occurrence of cancer of the gall-bladder or ducts. I am convinced that, in some cases at least, the association of cancer of the gall-bladder with biliary calculi is due to primary calculus, with secondary development of malignant disease. A case came to autopsy in the Cincinnati Hospital in which the gall-bladder was dropsical; the communication with the cystic duct was obliterated. In the lower part of the cystic duct, imbedded in a mass of carcinomatous tissue, was a gall-stone almost as large as a cherry. The closure of the cystic duct at its entrance into the gall-bladder was, as I regarded it, due to ulceration and cicatrization following the passage of the stone. The stone became arrested in the lower part of the duct, and, by the

irritation it set up, led to the development of malignant disease. The relation which gall-stones bear to cancer of the gall-bladder or ducts is of great moment as bearing on the question of the surgical treatment.

When shall an operation be undertaken in a case of gall-stones? What operation is to be chosen? Surgeons of eminence regard operation as indicated in the following conditions:

1. In cases having repeated attacks of biliary colic, with rapid exhaustion of the patient.

2. When there is evidence of suppuration in the gall-bladder, or its neighborhood, set up by the gall-stones.

3. In cases with acute or perforative peritonitis, starting in the region of the gall-bladder, when there is a distinct history of gall-stones.

4. In obstructive jaundice, when there is reason to think the common duct is occluded by gall-stones. As bearing on the last indication, Courvoisier's sign is of value: "A distended gall-bladder is not found in obstruction of the ductus choledochus from stone; if the gall-bladder is distended, then the obstruction is due to other causes, as cancer or stricture of the duct."

There is also a consensus of opinion that jaundice, long continued, seriously prejudices the patient's chances of recovery; the danger is greater in direct proportion to the intensity and duration of the jaundice. Internal therapy must not be extended over too long a time if the patient suffer from prolonged or frequently recurring attacks. The earlier operation gives the best chance for recovery.

As to the choice of operation, it is difficult to lay down any hard and fast rules; the anatomical conditions revealed at the time of operation will greatly modify the surgeon's course. Mermann of Heidelberg, after an extensive review of the cases coming to operation in the surgical clinic, sums up as follows:

Cholecystendysis is the proper operation where the walls of the gall-bladder are nearly normal, and where its contents are either bile, mucus, or dropsical effusion. This operation gives the best prognosis.

Cholecystectomy is only indicated in extensive ulceration of the mucous membrane or malignant infiltration of the gall-bladder. In either event, the patency of the common duct or cystic duct must be assured by careful examination at the time of operation.

Choledochotomy is the operation where a stone is firmly impacted in the common duct and cannot be pushed into the intestine by gentle pressure.

Cholecystenterostomy must be restricted to those cases in which the common duct is rendered impervious by other causes than gall-stones, or where the removal of the stone is rendered hazardous on account

of difficulties in technique. To allow the stone to remain in the common duct is always dangerous. McGraw, in corroboration, says that the stone, if left behind, continues to cause pain and colic, and leads to further adhesions about the duct. The operation may give relief, though it fails to cure; but it is not known how long the fistula thus established between the duct and intestine will remain open, as the tendency of the orifice is gradually to close. Establishing a permanent external biliary fistula is the better plan, if the patient is too much depressed by the long-continued jaundice to bear a tedious operation. To this I may add that the making of an external fistula is by no means easy, as the shrivelled, thickened, and retracted gall-bladder, often adherent to neighboring parts, cannot always be approximated to the abdominal wall.

For all other cases, such as suppuration of the gall-bladder without ulceration, in normal gall-bladder, where the cystic duct is not patulous, or where there is danger of cholæmia from grave and prolonged jaundice, *cholecystostomy*, in a single operation, is the proper procedure. To make the operation in two sessions is only permissible when the patient's general condition is bad. The biliary fistula, after cholecystostomy, if left to itself, will usually close spontaneously. When it fails to do so, a bend or kink in the common duct is responsible. Small fistulæ are ordinarily not troublesome.

It remained for Gallic ingenuity to attempt the chemical experiment of effecting solution of an impacted stone during operation. In an operation made by Joutan on our distinguished colleague, Dujardin–Beaumetz, ether was injected into the obstructed duct to dissolve the obstacle. The patient, fortunately, survived to express his own disapproval of the innovation. The few drops employed could have had but little solvent action; to use a large quantity in the duct would mean to increase the danger of rupture.

Malignant disease of the gall-bladder and ducts has been considered in connection with malignant disease of the liver. Surgical aid may be invoked as the only possible relief.

As a pathological curiosity may be mentioned tuberculosis of the gall-bladder. The only case on record is reported by Heddæus. The condition was discovered at autopsy.

In many cases of liver disorder, acute and chronic, the full functional activity of the gland is not restored, though the more urgent symptoms may have been relieved. It is easy by a premature relaxation of precautions as to diet, exercise, and mode of life, for the patient to drift back into his previous morbid state. A test of the ability of the liver to do its full duty can, it is claimed, be made with a fair degree of accuracy, by examination of the urine. A constant

deficit in the total daily elimination of urea should, in the absence of disease of the kidney, be construed as depending on imperfect hepatic activity. Similarly, the appearance of strychnine in the urine, after its administration in physiological doses, may be taken as evidence of the failure of the cells to properly neutralize toxic principles. In either case, the patient should not be permitted to consider himself well, nor to depart from those lines along which his improvement has been effected.

DISEASES OF THE THYROID AND THYMUS GLANDS, MYXŒDEMA, CRETINISM, GRAVES' DISEASE, AND OBESITY.

By S. J. MELTZER, M. D.

DISEASES OF THE THYROID; DEGENERATION OR ATROPHY OF THE THYROID GLAND.

Historical Sketch.—Of late our knowledge of the importance of the thyroid to the normal metabolism of the animal body has attained a considerable increase. While there are still some text-books in use, published within the last ten years, in which atrophy of the thyroid is not even mentioned; and while only a short time ago experiments were quoted showing that the removal of the thyroid does not affect the condition of the animal in any respect (A. Bardeleben[1]), and though clinical medicine did not record any symptom which would indicate the absence or atrophy of the thyroid in the human being: we possess at present abundant proofs furnished by modern surgery and experimental physiology that the presence of the thyroid is essential to the life and health of man and animals. Clinical medicine can present well-characterized diseases which have their origin solely in the atrophy or absence of the thyroid gland; and diseases which for a short period appeared to be hopelessly incurable can now be treated with infallible success. And still more: we recognize in the thyroid gland itself a therapeutic agent of great value and manifold use. The history of this entire chapter is exceedingly instructive, and I shall attempt to give a short outline of it.

In 1873, William Gull[2] read a paper before the Clinical Society of London on "A Cretinoid State supervening in Adult Life of Women." He has given a clear description of a few cases with peculiar symptoms reminding one of cretinism. In 1878, W. Ord[3] read a communication on "Myxœdema, a Term Proposed to be Applied to an Essential Condition in the Cretinoid Affection occasionally Observed in Middle-aged Women." The cases described by Ord were similar to those described by Gull. One of these cases came to

a post-mortem examination. The jelly-like swelling of the connective tissue suggested the term myxœdema. The tissue of the thyroid gland was found to be entirely replaced by fibrous degeneration. Soon after similar reports appeared in the medical literature of other countries also. Charcot [4] named this condition *cachexie pachydermique.* In the few cases which came to an autopsy the thyroid was invariably found to be degenerated.

On September 13, 1882, in a communication made before the Medical Society of Geneva, Switzerland, J. Reverdin [5] reported that patients whose entire goitrous thyroid was removed soon show a peculiar condition. About seven months later, on April 4, 1883, Kocher [6] of Berne read his classical paper on cachectic conditions following the total removal of the goitrous gland, to which condition Kocher gave the name of *cachexia strumipriva.* At that time Kocher did not think that the cachectic condition was due to the loss of the function of the thyroid. On May 15th J. and A. Reverdin [7] published an article on myxœdema following extirpation of the thyroid. These authors took the ground that the complex of symptoms following the total extirpation of the thyroid gland is simply myxœdema—*operative myxœdema*—and suggested the idea that both forms, myxœdema and cachexia strumipriva, are due to the loss of the function of the thyroid gland. In October of the same year, at a meeting of the Clinical Society of London, Felix Semon [8] made the further suggestion that the loss of the function of the thyroid is probably the cause of all the three states: cretinism, myxœdema, and cachexia strumipriva. At this meeting a committee was appointed to investigate the entire question.

Soon after the communication of Reverdin became known, it was recalled that M. Schiff [9] had reported as early as 1859 that the removal of the thyroid in dogs was followed by a general tetanic condition of the animal. These experiments were for more than twenty years entirely ignored. Schiff [10] repeated them again and confirmed his former results. This time the statement brought out quite a large number of experimental investigations, with the usual course: some investigators denying the facts, others admitting them, but explaining them by some fault in the technique, etc. Finally all the opposition was overcome, due especially to the excellent works of Ferdinand Fuhr [11] and Victor Horsley.[12] The committee of the Clinical Society reported its prolonged and thorough investigation in 1887,[13] and by the weight of this report, as well as by the many important contributions coming from many independent sources, the following conclusion was practically settled:

The thyroid gland exerts an important function in the body of man and animals. When a child is born without a gland, or the

gland becomes degenerated spontaneously during infancy or childhood, a state of cretinism develops. If the degeneration occurs in adults, the result is myxœdema. The same results are obtained in man when the thyroid is totally removed by operation. The removal of the gland in animals brings on an acute tetanic outbreak, a condition which occasionally occurs also in man.[14] The difference between man and animals is probably due to the fact that in animals a healthy thyroid is removed, while in man the operation usually removes the goitrous thyroid and the body was already adapted to a moderate impairment of the function of the gland.

Later experimental investigations have cleared up many former experimental failures. Some accessory glands which are scattered all over the neck and in the chest or even within the trachea were not removed. These remnants become hypertrophied after the removal of the main gland, and assume its function. When these accessory glands or parathyroids are also removed, the *cachexia thyreopriva* can be produced even in rodents.

Of the American contributors to the literature of our subject, the treatise of Hun and Prudden[15] deserves special mention, as it ranks high among the writings on myxœdema and is largely quoted by subsequent writers. We should also record the statement made by Hansleutner[1] about Rush, reporting the observation that the total removal of the thyroid gland exerts a striking influence upon the brain.

While thus the etiology and symptomatology of the new diseases were brought to a finish, their treatment seemed to be in a hopeless state. Pilocarpine, arsenic, strychnine, and other drugs and therapeutic measures were recommended and employed; but nobody could report a permanent improvement, not to speak of a cure. However, the experimental study of the function of the gland soon brought forth a new plan of treatment.

Schiff reported (1884) that the implantation of a thyroid in the peritoneal cavity of the dog alleviates the results of the removal of the thyroid from the neck of this animal. Kocher soon tried this method in the human cases of cachexia strumipriva, but did not obtain any improvement. Von Eiselsberg,[16] however (1889), who confirmed the statement of Schiff, and Bircher[17] (1889) succeeded in alleviating all the symptoms of cachexia, once for three months and once for nine months, in a case of operative myxœdema with tetany, by implanting a human thyroid in the abdomen of this patient. Independent of the attempts of Kocher and Bircher, Horsley[18] (1890) advocated this method for the treatment of myxœdema and cretinism. The advice was followed out by many surgeons by burying the thyroid of a sheep either in the abdominal cavity or in some

[1] *Archiv für prakt. Medizin*, 1810.

place in the subcutaneous tissue. There resulted a decided improvement in all cases treated by this method, but in all cases sooner or later a recurrence of the symptoms took place. The expectation that the gland would vascularize and discharge its function in the new place was not realized; the gland becomes absorbed.

Bettancourt and Serrane [19] noticed the improvement on the second day after the grafting of the thyroid; this could only mean that the absorption of some of the juice within the grafted thyroid caused the beneficial influence. Furthermore, Vassale [20] (1890) observed the cachexia in dogs obviated by intravenous injection of an extract of the thyroid gland. A similar statement was made by Pisenti.[21] Thus the road was paved to the idea that the juice of the thyroid extract introduced into some place in the body could obviate the effects of the loss of the thyroid gland.

George R. Murray, in February, 1891,[22] made the suggestion to treat myxœdema by subcutaneous injections of an extract of the thyroid. In the following April [23] he himself instituted this plan of treatment, and in July, 1891, he presented to the British Medical Association a case of myxœdema remarkably improved by this new mode of treatment.

The most important step was made by Howitz [24] of Copenhagen, who in June, 1892, reported that he obtained a curative effect upon myxœdema by the administration by the mouth of the raw or cooked thyroid. Similar statements were made by Mackenzie [25] and by Fox [26] in October, 1892. The treatment was soon applied also to cretinism and operative myxœdema, with equally good results. A further practical advance was made by converting the thyroid into more convenient forms of administration: extracts, powders, tablets of the thyroid, became handy therapeutical agents which got into general use all over the world with uniformly good success.

The combined efforts of physiology, medicine, and surgery have, then, established the fact that in the absence of the thyroid gland a detrimental factor is rapidly developing within the body which causes the myxœdematous cachexia, and that the thyroid gland furnished another factor which, when introduced into the body, either by natural or artificial ways, neutralizes the detrimental effects of the opposite factor. What these factors are, and how and where they are produced, have been all along only a matter of speculation. In the last two years, however, those speculations have reached at least an experimental state, and some important points have been brought to light.

Notkin [27] succeeded in separating an albuminous, chemically well-defined, substance which when injected into animals produces symptoms somewhat similar to the cachexia strumipriva. This substance he has termed "thyroprotein," and believes it to be the deleterious

factor which produces the cachexia accompanying absence of the thyroid. The opposing factor Notkin believed to be an enzyme or a ferment.

In conformity with this view S. Fränkel[28] reports that he succeeded in separating from the thyroid an albuminous crystallizing substance which possesses the power to neutralize the cachexia strumipriva. To this substance Fränkel has given the name of "thyreo-antitoxin." A similar result was obtained by Drechsel,[37] a well-known authority on physiological chemistry, and it seems that Fränkel and Drechsel had partly identical substances in their hands which would speak for the validity of their statement.

E. Baumann,[29] however, in the fall of 1895, made the very important discovery that the thyroid gland contains iodine. He succeeded in separating from the gland a substance which contains all the iodine in an organic combination. To this substance Baumann originally gave the name "thyreo-iodine," but it is now in the market under the name of "iodothyrine." As the iodothyrine is not an albuminous substance it has certainly nothing to do with the thyreo-antitoxin of Fränkel; nevertheless Baumann claims that his products contain the entire effective principle of the thyroid gland.

It is now, then, an established fact, that the absence, atrophy, or progressive degeneration of the thyroid gland is the sole cause of myxœdema, a well-defined, newly recognized disease; of cretinism, an old well-known pathological condition, and of cachexia strumipriva, an offspring of modern surgery. Before entering upon a detailed presentation of the treatment of these diseases we shall proceed with a brief description of their symptoms.

Myxœdema.

Myxœdema is a disease of the adult, of idiopathic origin. Though occurring at all ages, the years between thirty-five and forty-five show the greatest number of cases. It occurs more frequently in women than in men (six to one). It has been seen nearly all over the world, but in some places more than in others. With regard to the exciting cause we have as yet no definite knowledge. There is in literature one case which was caused by syphilis,[30] another case by actinomycosis,[31] a few others were caused by the misuse of iodine (Mosler, Anderson, etc.), in a few cases Graves' disease preceded myxœdema (Baldwin, Bramwell, etc.), and in a few others there was a distinct hereditary predisposition (Ord, Hun and Prudden, etc.); for the vast majority of the cases, however, we have to state that the disease was of idiopathic origin.

The disease is recognizable at sight by the peculiar œdema and by

the "cretinoid" appearance (see Fig. 26). The œdema is solid, does not pit on pressure, and is not distributed according to the laws of gravity. The œdema of both lids, of the nose, of the lips, and of the supraclavicular region is most striking. The skin is dry, scaly,

FIG. 26.

Myxœdema. Mrs. N., Nov. 22, 1893.

and has a yellowish, waxy appearance. There are two bluish-red points on the cheeks, the everted lips are cyanotic, the gums spongy and bleeding easily. The hair on the head, axillæ, etc., is dry, faded, thin, and scanty, the nails are grooved and brittle. Temperature and pulse are below normal. The patient always feels cold and never perspires. The urine is rather scanty and generally contains some albumin. The bowels are constipated. The general movements are awkward and slow; so also is the speech. The mental capacity is affected, memory impaired, and hallucinations are quite a constant occurrence. There have been cases with real insanity.

The diagnosis should offer no difficulty. The character and the distribution of the œdema, the constant sensation of cold, and the total absence of perspiration will sufficiently distinguish it from Bright's disease and obesity, the only pathological conditions with which myxœdema could be confounded.

Cachexia Strumipriva.

Since the considerable progress which the surgery of the thyroid gland has made within the last twenty-five years, the total extirpation of the goitrous or otherwise affected thyroid has been often resorted to. In the surviving cases a state of cachexia was gradually developed which is in every respect similar to the cachexia of the idiopathic myxœdema. In some cases the cachexia is preceded by tetanic fits, which usually set in soon after the operation. The onset of the cachectic condition took place after a few weeks or even after a few months. In some cases the cachectic symptoms disappeared again after a few months' duration, on account of some normal gland-tissue which was left unintentionally, and which within these few months became hypertrophied, thus becoming enabled to provide the body with the necessary amount of thyroid secretion. When the cachexia strumipriva reaches its full development there is present, then, no special feature enabling us to distinguish this cachectic state from the idiopathic myxœdema.

Cretinism.

There is an endemic and a sporadic cretinism. The former occurs in greater frequency, but is mostly confined to certain localities—to "goitrous districts;" the latter is less frequent, but is to be found in all parts of the world. The sporadic cretinism has no thyroid. In the endemic cretinism the gland is often rather hypertrophic, goitrous; the microscopic examination of these glands, however, has revealed a total degeneration of the follicular tissue. We take the stand that all forms of cretinism are the outcome of an infantile myxœdema; this might be congenital, or the onset might occur at any period between birth and puberty. If we now state that in addition to the œdema and the nervous symptoms seen in myxœdema of the adult the infantile myxœdema causes the arrest of the bodily and mental growth, we can easily understand that the symptoms will vary according to the period at which the onset took place. Contrasted with the very short body of the cretin, the œdema of neck, stomach, etc. appears to be enormous. The broad and retreating nose, the retreating and narrow forehead, the very small gazeless eyes, the thick lips, and the protruding tongue present a beastly expression that, once seen, is never to be forgotten. The intellectual faculties are sometimes far beneath those of the beast. No speech, no understanding, no recognition, and sometimes no perception whatsoever—an absolute intellectual blank. It is not my task here to give a detailed description. The symptoms of the disease are multiform, but the diagnosis offers no difficulty; the characteristic œdema will distinguish it from idiotism, and there is no other disease which could be confounded with cretinism.

Treatment.

There are on record a few cases of these diseases for which it is claimed that they improved without any treatment. Of the post-operative cachexia we have mentioned above it is said that in some cases the symptoms disappeared after a few months; that is, the accessory gland or the hypertrophied remnant of the normal gland-tissue, accidentally left over, attained a growth sufficient to take the place of the main part of the gland which had been removed. This is a very important consideration. We might assume that a thyroiditis or other pathological process affects now and then the greater part of the thyroid, so as to cause the development of symptoms of cachexia; after some time, however, either the process subsides and the thyroid attains its growth again throughout, or else the unaffected part becomes hypertrophied to a degree sufficient to provide the body with the necessary principle. Accordingly, one would think that spontaneous recovery should be possible even in so-called idiopathic myxœdema, especially in its undeveloped stages, of which as yet we know so little, and which may occur more often than we know at present. The case of myxœdema which was caused by syphilis was cured by anti-syphilitic treatment. The case which was complicated by actinomycosis of the thyroid improved after removal of the infected part. Tetanic attacks are often alleviated by sweating. Myxœdematous patients feel better in summer and in a warmer climate than in winter and in a cooler region. Pregnancy has a favorable influence upon myxœdema; the myxœdematous condition, however, seems to prevent conception. Here may be mentioned also a method of surgical treatment of the thyroid devised by Poncet.[1] He exposes both thyroid lobes, dusts them with iodoform, or introduces pieces of ivory in order to increase the secretion of the thyroid. The inventor of this method terms it *exo-thyréopexie*, and claims to have attained a wonderful result by the application of this method in a case of infantile myxœdema. As yet this statement has not been confirmed by anyone else; no judgment, therefore, can be passed upon its value.

The Thyroid Treatment.—The vast majority of all the cases reported in the medical literature were not improved until the thyroid treatment was instituted, but this therapeutic measure has indeed accomplished wonders.

The thyroid was employed as a therapeutic agent in five different ways: 1. The implantation of a thyroid from sheep or monkey (or human being) in the abdominal cavity or in the subcutaneous tissue of the patient; 2. The subcutaneous injection of an extract of the thyroid; 3. The administration of the thyroid or its preparations by

[1] *Lyon médicale*, April, 1893.

the mouth; 4. The administration of an extract of the thyroid by the rectum (Leichtenstern); 5. The inunction of a thyroid-lanolin cream (Menzies).

Since more convenient methods of administration of the thyroid were established, grafting has been given up entirely. The implanted thyroid sooner or later became absorbed, and the operation did not offer any advantage over the other more harmless methods of incorporating thyroid juice in the cachectic body. Of course, the grafting would accomplish an ideal cure if it would lead to a vascularization of the foreign thyroid in its new place, thus assuming permanently the function of the lost gland. Horsley has lately suggested to feed the patient with a thyroid preparation previous to the grafting, in order to implant the gland in a more normal tissue, where it would have a better chance to gain a foothold. As yet the proposition has not been brought to a practical test.

The extract for the subcutaneous injection was prepared with glycerin and the addition of some carbolic acid or thymol. It has often produced abscesses, phlegmon, erysipelas, etc. A striking fact was observed that some cases which did not respond to the subcutaneous treatment have derived, nevertheless, great benefit from the administration of the thyroid by the mouth. The subcutaneous method also has been very little employed within the last few years.

The employment of the rectal and the inunction methods seems to have been entirely restricted to their originators, and we are not in a position to judge whether these methods render any reliable results.

Practically, then, we possess at present only one method of incorporating the thyroid in the body, and that is the administration of the gland or its preparation by the mouth. Of the particulars of this method we shall speak later.

The effect of the thyroid upon myxœdema is a wonderful one (compare Figs. 26, 27, and 28). Twenty-four hours after having taken a small dose of thyroid the patients claim to feel improved. They are in better spirits and do not feel the swelling in their face in the morning on rising. After five or six days everybody can notice that the œdema is commencing to disappear, and the entire behavior of the patient undergoes a change. In a few weeks the change is so complete that often even intimate friends do not recognize the patient again. The most striking feature is, of course, the loss of the œdema, which leads to a considerable reduction of the patient's weight. In my case[32] of myxœdema the loss was nearly 50 lb. (see Fig. 28). The œdema disappears first in the upper part of the body. The skin becomes loose and baggy. With the disappearance of the œdema of the eyelids, the cheeks, the nose, and the lips, the patient loses the "cretinoid" appear-

ance. With the disappearance of the œdema of the neck one can establish the total absence of the thyroid gland. By the reduction in the size of the tongue and by the other changes in the nose, mouth, and throat the voice attains a normal sound. The skin peels off in larger

FIG. 27.

Mrs. N., Jan. 17, 1894, after eight weeks' treatment with thyroid.

FIG. 28.

Mrs. N., Feb. 24, 1894, after three months' treatment with thyroid.

and finer scales, and becomes smooth and soft. It often becomes covered with a fine lanugo which soon disappears again. A crop of fine hair develops on the head, axilla, and pubes. The new hair is mostly of another color than that of the old. The temperature of the patient goes up, the frequency of the pulse increases, the patient feels warm. Perspiration sets in again, and sometimes even becomes profuse. The amount of urine is generally increased; the albumin, if there has been any, is decreased or totally absent. The movements of the bowels become regular. Menstruation and sexual instincts turn into a normal course. The change in the mental condition of the patient is nearly as striking as the external transformation of the body. Instead of the hallucinations, mental sluggishness, and irritability of temper, the patient becomes sound of mind, active, and in good spirits.

All these favorable changes take place also in fully developed cases of *cachexia strumipriva*, when subjected to the thyroid treatment. If the thyroid is administered soon after the total extirpation of a goitre none of the symptoms of cachexia make their appearance. Surgeons

now very rarely remove the entire gland, since the detrimental effect of the total extirpation of the thyroid gland has become known. However, even after leaving a part of the goitrous thyroid, cachexia might develop, as nobody is capable of judging whether the part left contains enough of the normal gland-tissue to meet the requirements of the body.

As to the results of the thyroid treatment of cretinism, the favorable results are also striking, but are not so plain as in the myxœdema of the adult. Besides the favorable effect upon the myxœdematous tissues we observe an unmistakable influence upon the arrested growth, especially the growth of the bones. The influence upon certain symptoms of the nervous system can be noticed quite early. The clonic convulsions and epileptiform fits in my case,[33] which used to appear every few minutes, disappeared twenty-four hours after the first administration of a thyroid preparation. It is also quite certain that the mental faculties are favorably influenced to a remarkable degree; the extent of the improvement, however, varies greatly; while the change in some of the patients is surprisingly complete, there being hardly any difference between them and normal children, we meet with some disappointments in other cases; though, to be sure, they are no longer cretins, yet their mental capacity is not much above idiocy. Even with regard to their external appearance cretins show a greater tendency than myxœdema patients to become bulky again, even during the treatment, by the acquirement of normal adipose tissue.

The brilliant success of the thyroid-therapy has, however, some drawbacks. When the administration of the thyroid is discontinued, all the old symptoms gradually reappear one by one. Therefore, to keep our patients in a healthy state, we must give them all their life long a larger or smaller quantity of thyroid.

Again, the thyroid is by no means a harmless remedy. Overdosing with thyroid produces a number of more or less serious symptoms, the entire complex of which is now known under the term thyroidism. Certain symptoms of a disagreeable, but of a less serious and of a passing character are nearly constant companions of the administration of the thyroid. Ten or fourteen days after the institution of the treatment, even with moderate doses, the patient complains of an occipital headache, of "rheumatic" pains all over the body, of a tremor, and of general weakness. But these ailments are comparatively easy to remedy and usually soon pass by. Sometimes, however, there arise more serious and more persistent complications. Gastric trouble sets in, with persistent vomiting and profuse diarrhœa. Foulis[34] reported the death of a patient due to this condition. There occur sometimes tachycardiac attacks of quite a dangerous nature. The pulse goes up to 140 or even 180, becomes

thready, the patient becomes dyspnœic, feels extremely oppressed, and looks ghastly. Sometimes an increase of the temperature is present. Indeed in a few cases these attacks terminated fatally. However, these fatal results occurred only at an early stage of the new era, before the character of the remedy was well known; at present we no longer hear of such grave occurrences. Finally, some cutaneous disorders of a stubborn and annoying character, like urticaria, erythema, and eczema, have often accompanied the thyroid treatment. Sometimes sugar or albumin appears in the urine. It is probable that many of these symptoms are not to be considered as effects of the curative principle of the thyroid; they do not constitute the symptoms of thyroidism proper. The gland consists of proteid matter in the decomposition of which ptomaïnes and leucomaïnes are found; we may well assume, then, that many of the alarming symptoms are due to the ingestion of these poisonous substances (Lanz,[35] Cunningham[36]). However, it is not to be denied that the effective principle itself might, when given in excess of the necessary neutralization of the element of the cachexia, affect in an abnormal degree the metabolism and the regulation of the nervous system in a manner opposite to the *cachexia thyreopriva*—athyreosis and hyperthyreosis. However this may be, our practical interest centres in these two points: 1. These complications soon disappear after discontinuance of the administration of the thyroid. 2. When the thyroid preparations are carefully selected and the dosage is carefully guarded, most of the untoward symptoms can be well avoided.

The thyroid can be given by the mouth either in the natural state, finely minced, raw, or slightly cooked; or in glycerin-extracts; or the entire thyroid is converted into a dried powder which is dispensed in capsules, tablets, or pills. Or, finally, the gland is reduced by a complicated chemical process to a substance free of albuminous matter, and then thoroughly mixed with sugar of milk, and dispensed in powders, tablets, or capsules—the iodothyrine of Baumann.

The administration of the unprepared thyroid has not been and will not be in extensive use. Even when slightly cooked it remains a disgusting article of food, and a thorough cooking might after all destroy the effective principle of the gland. Besides, if the obtaining of the thyroid from the animal be left to the patients or to the butcher, it will often happen that instead of the thyroid the submaxillary or the thymus gland will be taken; many instances of reported failures have been due to this mistake. However, it must be admitted that the ingestion of the entire fresh gland would be an ideal method, as thus the gland will surely contain all the effective parts of the thyroid without any of its decomposed proteids. The disgusting taste could be partly overcome by advising the patient to wrap the minced gland

in a wafer, a method which I have often resorted to in the use of the thymus gland. The glycerin-extracts of the thyroid have been in use more extensively than the fresh glands, though surely with fewer good reasons. The extracts always contain more or less decomposed albuminous matter, and probably do not contain some good parts of the curative principle which, like the thyreo-iodine of Baumann, for instance, are not soluble in glycerin. The form which has come to be most extensively used is that of the dried and powdered gland dispensed in capsules, tablets, or pills. The success is without doubt due mainly to the convenience with which it can be obtained and dispensed; otherwise this form more than any other contains many decomposed proteids which assert their presence by an odor not to be disguised by a coat of sugar or gelatin. The desiccated powder and the tablet made from it are at present manufactured by many wholesale firms all over the world; we cannot give a full list of the brands. The tablets of Burroughs, Welcome & Co. of London have attained great renown in all parts of the world. Besides these tablets, we have in our own market the powder and tablets of the well-known firm of Parke, Davis & Co. and of Armour & Co. All these preparations are made from the sheep's thyroid, though the thyroids of other animals (ox, calf, swine, etc.) prove to be effective. Each tablet of Burroughs, Welcome & Co. is equal to five grains of the fresh thyroid. Two grains of the powder of Parke, Davis & Co. are equal to five grains of the fresh gland, the average weight of an entire thyroid of a sheep being estimated to be about twenty-four grains. Twelve grains of the powder of Armour & Co. are equal to an entire gland; one tablet contains two grains of their powder. I have obtained favorable results with the preparations of all the three firms, but I have had the best results from the powder of Parke, Davis & Co. and have seen more complications from the products of Armour & Co.; urticaria, for instance, was an early and constant companion to the administration of their powder. However, the accident might have influenced my experience, and I intend neither a special recommendation of the products of the one nor a slight to the products of the other firm.

The treatment should be started with small doses. One capsule (or a part of a tablet) containing powder corresponding to two grains of the fresh gland is sufficient to begin with. For the following few days there might be a daily increase of one grain. When the dose of six or eight grains is reached, it is better not to increase any more for a while and to watch the result achieved by these daily doses. If in a few days no unpleasant symptom makes its appearance, the increase with one grain a day can be resumed, continuing it for three or four days, then to be followed by another and longer intermission. If

the patient is still not showing any untoward symptoms the increase might be again resumed. However, 15 grains a day should be the final maximum even when the patient shows a great tolerance for the remedy. When large doses are given it is better to dispense them in two or three parts than in a single dose. It is true that a single large dose seems to have a more immediate effect than the same amount given several times in smaller doses, but it is the large dose which also brings out the alarming attacks. When occipital headaches, pains in the body, or urticaria set in, the increase should be discontinued and a decrease of two or three grains in the daily dose should be made. Phenacetin will remedy the headache, salicylate of sodium relieves the general pains, and a few small doses of pilocarpine drive away the urticaria. If, however, more serious symptoms appear, if the vomiting or diarrhœa or a very frequent pulse set in, the administration of the thyroid must be at once discontinued, the patient put to bed, and the individual symptoms as well as the general constitutional condition of the patient should be carefully watched and treated. The intermission should last at least eight to ten days, and when the treatment is again resumed the patient must be kept on only small doses of the thyroid for the next two or three weeks.

When the patient is undergoing an energetic thyroid treatment the diet should consist mainly of milk and vegetables; a meat diet seems to facilitate the outbreak of the more dangerous symptoms of thyroidism. The patient should be also guarded against too much exertion, and should be given iron and strychnine, of the latter $\frac{1}{20}$ of a grain three times a day.

If the thyroid treatment be carried out with conservatism, patience, and caution, no unfavorable effects are to be feared, and the good results are sure to come.

It was stated above that to maintain our athyreotic patients in a favorable condition they have continually to be treated by the administration of the thyroid. We must, however, distinguish between the treatment required to combat the myxœdematous cachexia already present and that adopted for the purpose of preventing a recurrence of cachexia. As soon as the condition of our patient is reduced to a state which would seem to be about normal the large doses of the thyroid are to be discontinued. All agree upon this, and also upon the further fact that the patient requires a continual after-treatment with smaller doses of thyroid. But there are as yet no definite rules as to how to proceed with these small doses. Some writers seem inclined to continue giving very small doses every day—just an imitation of the normal function of the thyroid; others give a somewhat larger dose once in three or four days; some give once a week, and some others speak even of once in a few weeks. In fact, while we have

quite numerous detailed reports of success in the treatment of myxœdema, we have very few reports telling us of the further course the disease has taken during a longer period after a "cure" has been effected.

The statement which I am going to make here is mainly derived from my own experience: No matter which method we may employ, it will not prevent the earlier or later reappearance of well-marked symptoms of the cachexia. If small doses are given daily the recurrence comes quite early; soon the doses are to be increased, and the increase is to be kept on until a period is reached when even such doses as were maximum at the initial treatment are not sufficient to exert the desired influence. When a larger dose is given once a week the recurrence of pronounced symptoms is distinctly delayed, but only delayed, the recurrence is bound to come, and what is worse, the preparation we employ fails to produce any further effect.

After some experimenting I adopted the following procedure: At first I give a dose of 10 to 12 grains once or twice a week for three or four weeks. Then I discontinue the treatment for some weeks entirely, with the avowed purpose of letting some of the symptoms of the cachexia come on again. Now, even such small doses as 3 grains three times a day are sufficient to reduce within a week most of the unpleasant symptoms. After continuing this treatment for one week more I go back again to once a week, and so on. The increase of weight I do not consider as a symptom of relapse, as some cases after losing their myxœdematous tissue are apt to increase in weight by acquiring healthy adipose tissue. I look upon the sensation of cold and the loss of the ability to perspire as sufficient evidence of the recurring onset of myxœdema.

The recurrence of these symptoms I have seen take place before any of the mental or other disagreeable features set in; the patient, therefore, suffers little by allowing some of the symptoms to reappear. In contrast with the normal function of the thyroid, the body seems to become less responsive to the daily artificial introductions of the thyroid, while susceptibility seems to develop when the body is subjected for some time to the thyroid inanition. In connection with the difficulties thus spoken of the following statement is of practical importance: If a preparation which was employed for some time fails to elicit any further effect, it should be put aside and a preparation from another source should be given, and the success is again assured; later on, the first preparation can again be administered with the original favorable effect. This somewhat surprising statement comes from several independent sources and I can confirm it from my own experience.

IODOTHYRINE.—About a year ago Eugen Baumann discovered the

presence of iodine in the thyroid gland. It was the first intimation that the body contains iodine in an organic combination, and has shown to us that as yet we do not even know all the elements the animal body contains. Baumann thought at first that the thyroid is the only organ of the body where the iodine is stored up; but he himself soon detected it also in the thymus gland, and Drechsel[37] found it in human hair. With the administration of iodine salt the amount of iodine in the thyroid gland is increased. The presence and the amount of iodine in the gland depends upon whether the food which the animal is fed with contains iodine (sea-fish, plants) or not. The quantity of iodine present in the human thyroid seemed to vary also with the locality in which the person is living. Of the human thyroids which were examined for iodine Baumann found that those coming from the vicinity of Freiburg (goitrous region) contain more iodine than those coming from Berlin or Hamburg. He succeeded in separating the iodine-bearing substance from the gland by a series of chemical procedures. This substance is insoluble in water, alcohol, acids, etc., is free from albuminous matter, and contains phosphoric acid in a very small quantity, while the iodine in this substance amounts to nearly 10 per cent. To this substance the name of "thyreo-iodine" was first given; it is now manufactured on a large scale at the well-known Farben-fabrik of F. Bayer & Co., Elberfeld, Germany, and is in the market under the name of "iodothyrine." The substance is now mixed with sugar of milk and arranged so that 15 grains (1 gramme) of the powder is about equal to 15 grains of the fresh gland and that 15 grains of the powder contain $\frac{1}{200}$ grain (0.3 of a milligramme) of the iodine. Baumann and Roos have tested the effect of this substance upon the cachexia thyreopriva of dogs (and upon human goitres) and obtained the same favorable results as from the feeding of the gland-substance itself. Their statements were confirmed by other experimenters; the dissenting report of Gottlieb[38] cannot be given very much consideration, as it is doubtful whether he had the proper substance in his hands (see, however, the article of Cunningham). The efficacy of iodothyrine has been tested in human beings on cases of myxœdema, goitre, and obesity.

I am not aware of any report of the therapeutic use of iodothyrine in this country. I have used iodothyrine for a few months; the results are satisfactory, indeed, but they differ in some respects from those seen after the administration of the gland-substance itself. After permitting a myxœdema patient to develop distinct cachectic symptoms, including mental manifestations and development of some myxœdematous tissue, I placed her upon the treatment with iodothyrine. I started with 5 grains three times a day and had it increased within two weeks to 30 grains a day. All the symptoms of

the cachexia gradually subsided, but the improvement took place quite slowly, much slower than when administering any of the other preparations. As stated above, 15 grains of iodothyrine are about equal to 15 grains of fresh gland. When I administered from the other preparations the quantity equal to 15 grains of the fresh gland, the subsidence of the symptoms went on quite rapidly and was more pronounced than after giving for some time 30 grains a day of iodothyrine. But, on the other hand, with the other preparations I hardly ever could overstep the limit of 15 grains without being halted by serious complications; with the iodothyrine, however, even after taking 30 grains a day for a number of weeks the patient did not experience any unpleasant symptoms whatsoever.

Baumann claims that iodothyrine contains the entire anti-cachectic principle which is present in the entire gland, and ignores the statements of S. Fränkel with regard to the importance of his thyreo-antitoxin. There are, however, sufficient reasons to disagree with this view of Baumann's. Drechsel, also a well-known authority on physiological chemistry, reports that he has succeeded in separating two distinct albuminous substances which prove to be efficacious upon thyroidectomized dogs. One of these substances is apparently identical with Fränkel's thyreo-antitoxin. Drechsel believes that there must be at least three different substances in the thyroid gland, all of which have more or less the same anti-cachectic influences (compare also the article of Cunningham). A striking point against Baumann's view is the fact that curative results were obtained by alcoholic and glycerin extracts. As iodothyrine is insoluble in alcohol and glycerin, these extracts did not contain Baumann's substance, nevertheless it is just these extracts which have inaugurated the thyroid-therapy.

Finally, I might quote, if I am permitted, my own experience with iodothyrine, which has shown a distinct delay in the effect in comparison with the effects obtained from the preparations coming from the whole gland. It seems to me that there can be no doubt that the iodothyrine represents only a part of the effective substance of the thyroid. Nevertheless I would strongly advocate its employment. It does not contain albuminous matter, it does not contain toxins and ptomaïnes, and it does not decompose at all; even after months there is no odor or any other sign of decomposition. Therefore, perhaps, the iodothyrine does not cause so often those disagreeable symptoms which are unavoidable when the other preparations are used in efficient doses. I have adopted for the present the method of alternating larger doses of iodothyrine with smaller doses of other preparations, thus increasing the efficacy of the treatment without causing any untoward complications. Iodothyrine offers also the advantage of a more rational dosage. While in the other prepara-

tions we are practically unable to judge whether a certain quantity contains much or nothing of the effective principle, we know, when we dispense iodothyrine, exactly how much iodine we administer, and it is at least a plausible hypothesis to assume that the effective principle in the iodothyrine is in proportion to the amount of iodine present. Taken all in all, iodothyrine marks a considerable practical progress in the therapeutics of the thyroids. The only trouble with this preparation, at least for the present, is its high price.

Goitre.

The hypertrophy, or more correctly the enlargement, of the thyroid gland is termed goitre. This diseased condition is either congenital or acquired. In the latter case the development is either acute or chronic. We have to distinguish between sporadic and endemic goitre. Sporadic cases of goitre are evenly distributed all over the world, but they are comparatively rare. The endemic goitre is confined to certain regions, of which the central Alps in Europe are a striking example. In the goitrous districts which are to be found in all parts of the world this disease is quite of frequent occurrence, and plays quite an important part in the life of the population. There are on record also epidemics of goitres occurring even in regions where the goitre is not endemic.

Mechanical effects have something to do with the causation of the sporadic goitre. It develops during pregnancy or parturition, it may come after trauma, the development is influenced by all movements which produce hyperæmia of the thyroid: constant work with the head down, cornet-playing, etc., emphysema, valvular heart trouble, etc.; but it is very doubtful, to say the least, whether these mechanical factors are the sole cause of the development even of the sporadic goitre.

As to the origin of the endemic goitre many theories have been advanced. St. Lager[39] enumerated more than forty. There seems to be at present unanimity of opinion on one point—namely, that the drinking-water contains the evil factor. There is quite a divergence of opinion, however, as to what this factor may be. Some connect it with the difference in the geological strata with which the water comes in contact; some accuse the presence, some the absence, of certain inorganic substances in the water. Others think of organic substances, and still others of specific germs, of bacteria. We mention these theories inasmuch as they have some bearing upon certain prophylactic measures.

Goitre occurs in women more frequently than in men. Heredity is a recognized factor. The goitre is either unilateral, when mostly the right lobe is affected, or it extends over both lobes; it also starts

sometimes from the isthmus. Usually it is located in front of the neck; in some cases, however, the location of the goitre is subclavicular or substernal, or it is wandering—*i. e.* it is sometimes within and sometimes outside of the anterior mediastinum. The goitre can also sometimes be submaxillar, retro-pharyngeal, or retro-tracheal.

With regard to the differences in the structure of the enlarged thyroid gland, the goitre is divided into many forms, the knowledge of which is of practical importance. In a parenchymatous or follicular goitre the enlargement is due to the increase in the number of the follicles. If the follicles themselves are degenerated and contain a large amount of colloid, the enlargement is termed colloid goitre. In a cystic goitre the walls between many enlarged follicles are atrophied, and the follicles form together one large cyst which may contain colloid material, serum, or blood. A cystic goitre may contain one or many such cysts. The hypertrophy of the interglandular connective tissue is the pathological basis of a fibrous goitre. Finally, in a vascular goitre the blood-vessels are dilated. In many cases all of these changes are to be found in one and the same goitre. In many cases of goitre the course is slow and the patients are but little affected by the disease. In other cases, however, the goitre is the source of serious troubles, and the patient is constantly in danger. The pressure upon the soft trachea and upon the recurrent laryngeal nerves causes chronic dyspnœa and sometimes sudden asphyxia and death; the pressure upon the sympathetic often causes headache, and the pressure upon the pneumogastric or accelerating nerves causes tachycardia and palpitation.

Treatment.

Children of goitrous parents should be removed from the goitrous district. The same applies to the goitrous people themselves, as there are cases on record where goitre disappeared after the patients removed to another locality. Even entire epidemics were suppressed by this method (see Ewald). Improvements in the general sanitary condition have a favorable prophylactic effect upon the development of the goitre. The hygienic condition of the individual has also something to do with the acquisition of the goitre. The water should be filtered and boiled, or, still better, rain-water or water conducted from another non-goitrous region should be used.

Acute sporadic cases often disappear spontaneously without further treatment.

The treatment of goitre can be either medical or surgical. The medical treatment consists in external applications, in intraglandular injections, and in internal administration of medicines. The drug which hitherto has been mostly employed and has given the most

satisfactory results is iodine. For external applications on the goitre have been used either the plain tincture, or iodine and potassium iodide in solution (iodine 1, potassium iodide 5, water 100), or iodide of potassium or iodoform-salve with lanolin. Also mercurial preparations have been employed for external use. There are many statements with regard to favorable results achieved by this method. Personally, I have seen no influence whatsoever from these external applications. We might mention here also the claim that cataphoresis (with iodine) effected a cure; also that the galvanic current (60 milliampères) is recommended in goitre.

The intraglandular injections are made by first inserting the needle of a hypodermic syringe, and when blood is not coming the syringe is attached and the fluid injected, thus preventing the dangerous injection into a blood-vessel. Tincture of iodine is mostly employed: 10 to 15 drops every few days until ten to twenty injections are made. Good results were obtained in parenchymatous goitres; some claim a certain improvement also for fibrous and cystic goitres. There is a positive contraindication to employing this method in colloid and vascular goitres. Mosetig v. Moorhof recommended iodoform (iodoform 1, ether 5, olive oil 9; the mixture not to be exposed to sunlight). Injections were also made with perchloride of iron, alcohol, Fowler's solution, osmic acid, ergotin, carbolic acid, etc. It seems to be the general opinion that all these remedies are not by any means so effective as iodine, and on the other hand are a good deal more dangerous. We must state, however, that there are on record about thirty deaths following the injection of iodine into the goitrous mass. In view of this fact, and in view of the fact that we now possess remedies and methods at least as reliable as the intraglandular injection, this method should be entirely discarded.

Administration of potassium iodide internally has unquestionably accomplished in very many cases a reduction of the goitre; 10 to 15 grains a day is a sufficient dose. Also other preparations of iodine were given, like iodide of iron, iodoform ($\frac{2}{3}$ of a grain three times a day in pills), spongia usta, etc. However, the administration of iodine has also a drawback. It sometimes produces a complex of symptoms which has been termed *iodism*. The patient became thinner, had palpitation, felt sick, and sometimes even had fever. These symptoms used to appear soon after taking small doses, when there was a rapid decrease in the goitre. There is at present a general inclination to consider iodism as a sort of cachexia strumipriva, under the assumption that the iodine has reduced also the normal gland to an ineffective minimum. It seems to me, however, that the symptoms of iodism remind one rather of Graves' disease than of myxœdema. We should note here that according to Woakes [40] hydro-

fluoric acid (20 to 25 minims of a $\frac{1}{2}$ per cent. solution) has proven to be very effective even in cases which did not respond to the treatment with iodine.

The Treatment of Goitre by Thyroid.—While studying the effect of thyroid-feeding upon insanity, Reinhold [41] made the accidental observation that in goitrous patients during the administration of the thyroid the goitre became distinctly smaller. Soon after, Bruns [42] started a systematic treatment of the goitre with thyroid and obtained very favorable results. There are already numerous reports confirming the statements of Reinhold and Bruns, and the successful treatment of goitre with the thyroid gland can safely be considered as a well-founded fact. From my personal experience I would say that the treatment of the goitre with products of the thyroid brings about decidedly better results than the treatment with iodine. The method of administration is the same as in myxœdema, only that the increase in the doses can be pushed much farther and more rapidly. There is a limit to the administration of the thyroid, also, in the treatment of goitre—large doses will finally produce thyroidism; but goitrous persons seem to stand the ingestion of thyroid better than do myxœdematous patients, also the symptoms seem not to become so grave, and they disappear soon after the discontinuation of the thyroid-feeding. The goitre seems to share, however, the fate of myxœdema as far the relapse is concerned. There are so far only a few cases on record with an absolute cure, and besides the period of observation is as yet too short to enable us to form a positive opinion. The form of enlarged gland which benefits mostly by the thyroid treatment is the parenchymatous goitre; however, even the fibrous, colloid, and cystic goitres benefit greatly by the treatment, inasmuch as nearly all the goitres contain some soft tissue which is absorbed and by which the goitre becomes smaller and the adenomata or cysts become more distinct and more amenable to surgical treatment. The subjective symptoms, especially the dyspnœa, seem to improve soon after the administration of one or two doses and long before the decrease of the goitre can be noticed. I can further report that iodothyrine also effects a reduction in the size of the goitre; but here, too, as in myxœdema, the effect is much slower than the one produced by the ingestion of the preparations which contain the substance of the entire gland.

Treatment of Goitre by the Thymus Gland.—Mikulicz [43] has reported that the use of the thymus gland produced similar results to those attained by using the thyroid gland. His experience was derived from the treatment of 10 cases. Reinbach [44] has followed him with a report of 30 cases, 20 of which were positively improved. The improvement is just as marked as that effected by the treatment

with thyroid, and in some cases the thymus brought relief where the previous treatment with thyroid did not yield any result. The main advantage of the administration of the thymus gland consists, however, in the fact that it can be given in large doses and for a long time without producing any untoward symptom. I can emphatically confirm this statement, as a patient of mine has been taking large doses of raw thymus from the lamb every day for the last year without having any unpleasant symptom whatever. Mikulicz and Reinbach employ mostly fresh, raw glands finely minced. They start with 10 to 15 grammes ($\frac{1}{2}$ to $\frac{2}{3}$ oz.) three times a week, and increase the dose even to 30 grammes (1 oz.), though they do not believe that the larger doses effect better results. There are already in the market tabloids of thymus. There is less trouble in obtaining fresh thymus than thyroid glands, as the butchers well know the former and do not know the latter.

The surgical treatment of the goitre lies outside of the scope of this chapter, and we shall therefore restrict our reference to this method of treatment to only a few remarks. Excision of the entire gland is not now practised; usually about one-fourth is left in order to prevent the development of the post-operative myxœdema. This part, however, might not contain sufficient normal tissue, and it is therefore advisable to start with some thyroid-feeding in order to prevent a possible tetanic outbreak. Thyroid-feeding should also precede the operation, for the purpose of bringing out more clearly the cysts or adenomata. Angerer, however, believes that this previous feeding with thyroid was the cause of a death which soon followed the thyroidectomy, the assumption being made that the thyroid-feeding had a weakening influence upon the heart. There cannot be such an objection to the administration of the thymus, if the statements of Mikulicz and Reinbach are generally confirmed.

There are at present many operative measures which have their indications according to the special requirements: Division of the isthmus to relieve tracheal pressure; incision and drainage of cysts; enucleation of cysts, adenomata, etc.; partial resection of fibrous goitres, and the ligation of the thyroid arteries, especially in vascular goitres. Ligation of all the arteries is not, however, now practised, as it is found to produce a cachexia similar to that which appears after total removal of the goitrous gland.

Modern, progressive surgery devised and developed all these fine operative methods before we had at our disposal the new era of the successful medical treatment. How often we may still have to resort to operative treatment, when dealing with emergencies arising from the goitre, the future will teach us.

Other diseases of the thyroid and their treatment do not require an extensive description.

Hyperæmia occurs during menstruation, pregnancy, parturition, or may be due to any pathological course which offers a resistance to the return of the venous blood from the neck (mediastinal tumor, valvular heart trouble, emphysema). The treatment is directed as far as possible against the primary cause. Some simple hygienic measures, like the avoidance of a tight corset, a tight collar, of sitting with the head bent forward, of climbing stairs, mountains, etc., are all that can be advised.

Thyroiditis is an inflammation of the thyroid which is either idiopathic or occurs as a sequel or complication or metastasis of many infectious diseases. It occurs also and even more often in a goitrous thyroid; it is then termed strumitis. There is a large, painful swelling over the region of the thyroid, and this is often accompanied by high fever and with chills. It lasts between a few days and a few weeks. The swelling either resolves or it forms one or more abscesses which, when left to themselves, will find their way either outside or into the mediastinum, trachea, etc. The treatment should consist, at least at the beginning, in cold applications in any form; perhaps leeches to the jugular region, inunction of iodoform-salve, and thorough evacuation of the bowels. Exploration with the aspirating needle has to be practised early, in order to detect the formation of an abscess, which must be evacuated and treated in accordance with surgical principles.

Tuberculosis of the thyroid gland is mostly secondary; its treatment is that of tuberculosis in general.

Syphilis of the thyroid is very rare; in one case it gave rise to development of myxœdema, which was subsequently cured by antisyphilitic treatment.

Echinococcus of the thyroid is also quite rare; it might be taken for a cystic goitre, but the aspiration will clear up the diagnosis. The treatment is incision and drainage or enucleation, if possible.

Actinomycosis of the thyroid occurred in one case. There have been symptoms of myxœdema; the patient was cured by the resection of the infected part.

Sarcoma of the thyroid is more rare than *carcinoma;* both are met more often in goitrous regions and occur also more often in a goitrous than in a normal thyroid gland. It might be difficult to distinguish between a benign goitre and a malignant tumor. The goitre displaces the large blood-vessels; the malignant tumor embraces them, is adherent to the skin, and forms metastases in the neighboring lymphatic glands. In a case described by Treupel [45] the absence of the effect of iodothyrine upon the swelling was em-

ployed as a means for differential diagnosis. The treatment is quite hopeless. The operative removal is very difficult and the results are usually bad. Under these circumstances a trial should be given to the toxins of the erysipelococcus (Coley [46]) or to the cancer-serum of Emmerich [47] and Scholl or of Richet and Héricourt.[48]

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We refer also to Cunningham's article on "Experimental Thyroidism" in the *Journal of Experimental Medicine*, vol. ii.

GRAVES' OR BASEDOW'S DISEASE.

Exophthalmic goitre was described by Graves[1] in 1835 and by Basedow[2] in 1840. It is an established fact that the disease was seen first by C. H. Parry in 1786, and was described by him in a paper which was published, after his death, in 1825.[3] It would, therefore, be more correct to let the disease be known by the name of Parry—"Parry's disease."

The disease is generally known by its three striking symptoms—tachycardia, goitre, and exophthalmos. The eye shows other symptoms which are more or less peculiar to this disease: 1. The unnatural width of the palpebral fissure and the diminished frequency of the normal blinking: Stellwag's symptom.[4] 2. The upper lid does not follow the downward rotation of the eyeball: Von Graefe's sign.[5] Both signs are early symptoms and are often present before exophthalmos is developed; they are more constant symptoms of Graves' disease than the exophthalmos. 3. The insufficiency of convergence;

a near point cannot be seen with both eyes at once: Moebius' sign.[6] There are sometimes present peculiar rapid vibrations of the eyeballs, and also all degrees of paresis, including complete ophthalmoplegia. The exophthalmos and all the other symptoms are mostly present in both eyes; in some cases, however, only one eye shows the abnormality. The exophthalmos can be of all degrees, and is sometimes, perhaps, so moderate as to be overlooked entirely. In the cases on record in the literature the presence of exophthalmos is noted, as it seems, only in 80 per cent. All authors seem to agree that the exophthalmos is not essential for the diagnosis of Graves' disease.

The goitre, too, is in Graves' disease sometimes only unilateral, and then mostly on the right side. Until lately it was believed that the goitre in this disease was mostly of a vascular type. Recent anatomical investigations, however, have shown that a glandular degeneration is constantly present; F. Mueller[7] found this degeneration of the thyroid in a case of Graves' disease with no goitre. Also the cystic and fibrous forms of goitre are not so rare in this disease. The goitre either appears simultaneously with the symptoms of the disease or it develops later. There are cases where a goitre was present for some time before any of the other symptoms set in. Buschan[8] considers such cases as pseudo-Graves' disease, though they may show all the other symptoms just as well as the "genuine" disease. However, the classification of Buschan is apparently made to satisfy his favorite theory of the nervous origin of the disease. As to the constancy, some authors have distinctly stated that in their cases a goitre was absent. Moebius,[9] however, distrusts this statement; the goitres might have been so small that they were overlooked. Moebius, too, is prompted to his opinion by his advocacy of the thyroid origin of the disease.

With regard to the tachycardia, there is hardly a dissenting voice to the verdict of Charcot:[10] No tachycardia, no Graves' disease. In mild cases the pulse is about 100 per minute; in severe cases it can go up to 140–150 per minute, and sometimes even over 200 per minute. Besides the increase in frequency, the heart-beat is strong; there is palpitation, and this is often the first subjective symptom the patients complain of. There is sometimes present, temporarily or permanently, dilatation of the heart, which leads now and then also to hypertrophy. A systolic murmur is infrequent, and is usually associated with anæmia. Genuine valvular trouble, if present, is only a complication, not an essential part, of Graves' disease. There is a strong pulsation in all the arteries of the body, especially in the carotids and the abdominal aorta. In some cases a thrill can be perceived in the goitre (Fig. 29).

Outside of these cardinal symptoms there are a number of other

symptoms which are met with quite often and are important for the diagnosis of the undeveloped forms of Graves' disease—*formes frustes*—and also for the prognosis of the disease. Charcot and Marie[11] have directed attention to a peculiar tremor which is present in many cases of the disease. It is sometimes confined to one side and even to one of the upper extremities. The tremor is to be distin-

FIG. 29.

Exophthalmic goitre.

guished from certain choreiform movements which are met with in some cases of Graves' disease (Kahler[12]). Diarrhœa is present in about one-half of the cases, and is sometimes the cause of the fatal outcome of the disease. It comes mostly in attacks recurring every few weeks. Vomiting is infrequent, but also quite a serious symptom of the disease. There are present quite a number of vasomotor phenomena. The patient blushes at the slightest provocation; feels a burning heat; has the *tache cérébrale;* urticaria; circumscribed œdema on all parts of the body.

There are many other symptoms: Pigmentation of the skin, reminding one of Addison's disease. Falling out of the hair on the pubes, eyebrows, etc. Profuse perspiration, which is the cause of the lessened resistance of the skin to the galvanic current: Vigouroux' sign (Chvostek,[13] Vigouroux[14]). Elevation of temperature, permanently or temporarily. Glycosuria, polyuria, polydipsia, and bulimia. The breathing capacity is diminished: Bryson's sign. General waste of the body and circumscribed atrophy of muscles; atrophy of the uterus.

Manifold symptoms of nervous origin: Paresis and paralysis of certain groups of muscles, "the giving way of the legs," the irritability of temper, the insomnia, all forms of hysteria, and many forms of insanity.

The disease occurs more often in women than in men (nearly five to one). Some cases have presented a striking history of hereditary influence. Eight children and two generations with Graves' disease in one family (Oesterreicher [15]), also three consecutive generations with this disease (J. Rosenberg [16]). Some sorts of nervous diseases were found to exist in the families of nearly every case of Graves' disease (however, if we look for them we might find the same proportion in the family history of every healthy person). It is claimed that the disease is more frequent along the sea-coast than inland, and that some races are more predisposed than others. As yet, however, there are no statistics for either of these claims. Among the incidental causes of the outbreak of the disease shock and fright seem to take the first place.

The onset is sometimes acute, but mostly gradual; the further course is nearly always chronic. Death occurred in 10–11 per cent. of all the cases, and is due either to some intercurrent accidental disease or to the heart or the intestinal trouble of the disease itself. Some cases have terminated in myxœdema.

The pathological anatomy of the disease is, except perhaps in the thyroid, nearly a blank. Changes in the sympathetic nerve, in the pneumogastric nerves, in the medulla oblongata, were recorded in some cases, but only in the minority and mostly by writers who had a theory to support. Those changes might have been artifacts or might occur even in normal bodies; nobody has studied the subject as yet. It is absolutely certain, however, that these changes are not essential to the pathology of Graves' disease.

There are many theories with regard to the nature and origin of the disease: The sympathetic nerve is paralyzed or is irritated; the pneumogastric nerve is affected; both kinds of nerves are affected; the location is in the medulla oblongata with an anatomical basis, or a simple functional neurosis; the brain-cortex is responsible; it is a form of hysteria.

The theory which stands at present in front of the discussion is that which assumes that Graves' disease is caused by "hyperthyreosis." Graves' disease shows a large number of symptoms which are diametrically opposite to those of myxœdema. This disease is due to the absence of the thyroid function—"athyreosis" or "dysthyreosis"—consequently Graves' disease is due to an abnormal increase of the function of thyroid: hyperthyreosis. Moebius [17] is the originator of this theory, which has many prominent followers also in this country,

like James J. Putnam,[18] M. A. Starr,[19] and F. Kinnicut.[20] Many proofs are now being brought forward in support of this theory: The symptoms of myxœdema disappear when thyroid is administered; however, an overdose of the gland produces "thyroidism"—that is, a complex of symptoms which are similar, so it is claimed, to those present in Graves' disease. It has also been stated that in some cases of thyroidism in man even a goitre made its appearance. Ballet and Enriques[21] reported that they had produced a goitre in a dog by subcutaneous injections of thyroid-extract. The theory itself is quite suggestive; the proofs, however, are not convincing. The statements of Ballet and Enriques have as yet not been confirmed by any other observers (see Cunningham[22]). As to the appearance of a goitre in man after feeding with the thyroid, I know of such a case. The man took large doses of thyroid and lost over forty pounds, and then a small goitre presented itself in the neck—it was there before, but had been covered by large masses of adipose tissue which disappeared by the thyroid-feeding. That is the way in which thyroid-feeding produces a goitre. With regard to the "thyroidism," we must remember that most of the symptoms are surely not due to "hyperthyreosation," but to intoxication from the decomposed proteids (O. Lanz[23]). Iodothyrine, though effective in myxœdema, does not readily produce thyroidism, and real fresh glands immediately cooked and administered, though otherwise effective, do not produce any of the symptoms of thyroidism (Cunningham).

Treatment.

The treatment of Graves' disease is to be considered under four heads, as follows: Hygienic, medicinal, electrical, and surgical treatment.

Hygienic Treatment.—Rest is in Graves' disease an indispensable measure. In acute cases or in acute aggravations in chronic cases the rest must be in bed and absolute. It prevents the progress of the disease and alleviates many of the symptoms. The tremor subsides, the heart-beats lessen in number, and the goitre and exophthalmos become appreciably smaller. During the course of chronic cases it should not be insisted upon that the patients stay in bed or go through the ordeal of a "rest cure," as this rather increases their irritability. They should be advised to rest a few hours every day, to avoid all exertions, prolonged and brisk walks and unnecessary climbing of stairs and heights. This does not apply to the systematic treatment by walking and climbing according to Oertel's method, which has its proper indications in some cardiac troubles, and which also was employed, it is claimed, with success in Graves' disease (Funkel[24]). Mental rest is also an important factor in the hygienic management

of this disease. Excitement of all sorts (including sexual) should be avoided as much as possible.

As to the selection of a place of abode, life in the country is preferable to living in the city; the sea-shore is well recommended by many writers. Mountain air is highly praised by some and warned against by other authors. A moderate altitude is probably beneficial. Many recommend it with the view of having permanent quarters. It seems to me that an occasional change of scenery and places has rather a soothing effect upon the depressed patients; they hope in winter to benefit by the country life in summer, and anticipate in summer the home comforts of the winter.

Balneotherapy is probably not a very important factor in the hygiene of Graves' disease. Chalybeate and acidulous springs are recommended. Schott[25] speaks well of Nauheim, which is now in vogue for some cardiac derangements. Sea-bathing is warned against by many authors, though it has its advocates. I had a sad experience with sea-bathing: A patient of mine with all the characteristics of Graves' disease, especially with strongly pronounced tachycardia and vasomotor disturbances, was stopping at the sea-shore. She was then at her best. One day she experienced an irresistible longing to try a sea-bath, which she had not had for many years. She went into the water against the energetic protestations of her family. She had had her feet in the water only a minute or two when she suddenly fell back dead. However, there are a number of cases on record of the sudden death in water—without submersion—of perfectly healthy individuals. It is claimed that in these cases the persistent thymus gland was found to be considerably swollen.[1]

A much more important factor is the hydrotherapy. The authors are unanimous in the opinion that partial or total wet pack, shower-douche, and other methods of hydrotherapy have proven to be beneficial in many cases of Graves' disease. Of course, the treatment has to be individualized according to the prevailing symptoms, preferring generally the more gentle methods of this therapeutic measure. The effects of the hydrotherapy can be assisted by judicous massage or mild applications of some of the methods of mechano-therapeutics. It is claimed that vibration of the ribs reduces strikingly the pulse-frequency (Winternitz[26]). We might mention here that some authors recommend a mild compression of the goitre or of the exophthalmos by mechanical appliances.

We should not omit to note that, according to some authors (Charcot, Buschan) pregnancy may be counted among the favorable measures in Graves' disease, and they advise its application "if possible."

[1] See Achilles Nordmann, *Corresp. der Schweizer Aerzte*, 1889.

Diet is another important point in the management of Graves' disease. With regard to the tendency to general waste of the body the patient has to be fed well, but with regard to the frequent occurrence of diarrhœa and vomiting the food has to be judiciously selected. Furthermore, the condition of the circulatory system requires the omission of alcoholic beverages, coffee, tea, tobacco, etc. One author went so far as even to deprive patients of mineral waters "because carbon dioxide is an exceedingly strong stimulant for the vasomotor centre." Von Hoesslin[27] reports the cure of a case of long standing by keeping the patient on a vegetable diet. W. H. Thomson[28] recently came out strongly in favor of an exclusive milk diet. This has already been advocated by v. Graefe, Friedreich, and others. Thomson thinks that Graves' disease is a state of auto-infection due to absorption of ptomaïnes from the gastro-intestinal canal. While it is, indeed, a generally acknowledged measure to restrict the meat diet in Graves' disease, the past has shown that the proposition to keep the patients on an exclusive milk diet has not acquired many adherents. However, in cases with gastro-intestinal complications Thomson's plan of treatment should receive a fair trial.

Medicinal Treatment.—Quinine had its day; we do not hear much of it now. Iron in any form was a favored remedy and is still greatly in use; but there are old and new statements to the effect that an aggravation of the symptoms often follows the use of iron. Digitalis is often prescribed, but it seems that in Graves' disease digitalis does not even reduce the number of heart-beats. The effect of strophanthus seems to be considered a little more favorable; at least there are as yet not as many writers denying its effect as is the case with digitalis. I have had no success with either. We should not forget that both drugs often interfere with the digestion. We should also bear in mind that an ice-bag or the application of cold in any other form on the præcordial region has also in Graves' disease an indisputable quieting effect upon the rapidly beating heart, a point upon which there seems to be no division of opinion among the writers. English and American writers praise the good effects of belladonna; it is given by the mouth or applied as a plaster on the præcordium or on the goitre. Potassium iodide is recommended by some authors and discarded by others; it reduces the goitre but increases the number of the heart-beats. It should be remembered that the administration of iodine in goitrous cases sometimes produces "iodism," a state which reminds us a good deal of Graves' disease. Bromides fulfil their mission—the patient becomes more quiet and finds sleep. The following drugs—arsenic, strychnine, picrotoxin, ergot, nitroglycerin, nitrate of silver, etc.—have been recommended by one or another author as useful remedies in Graves' disease. The statements

of the cures which have been effected by all these drugs can only serve as a proof that Graves' disease often gets better not only without but even in spite of certain treatments.

W. H. Thomson (see above) lays stress on the unremitting use of what he calls intestinal antiseptics. Two grains of calomel about once a week and the frequent use of phenol bismuth, naphthol bismuth, bismuth subcarbonate or salicylate, salol, ichthyol, etc. Of course, this is in conformity with his theory that Graves' disease is an auto-infection of intestinal origin.

Kocher[29] has lately introduced a remedy in the treatment of Graves' disease which was suggested to him by v. Trachewsky. It is the plain sodium phosphate given in quite large doses (2–10 grammes daily). Sahli and Kocher have obtained good results with this remedy; so have also Edes,[30] Starr,[19] and Moebius.[31] I shall verbally quote the latter's statement; it is quite instructive: "The inventor assumed that goitre in Graves' disease is caused by a diseased condition of the medulla oblongata. Semmola recommended sodium phosphate for diabetes: diabetes is a disease of the medulla: consequently, etc. In spite of this strange deduction I made up my mind to test this remedy, and to my astonishment the patients were well satisfied with it; they slept better and became quieter. Some thought they liked the new remedy better than the bromide powders." This shows that even poor theories are capable of bringing out useful facts.

The effects of the thyroid upon Graves' disease were tried in a good many cases. The majority of the writers state that it has a deleterious effect; but there are some authors who claim to have seen an improvement, and in a few cases even a cure of the diseases, by the administration of this gland. From the standpoint of the "hyperthyreosis theory" this seems to be unexplainable. My personal experience coincides with that of the majority. Only a few grains of the thyroid were sufficient to produce a pronounced distress; tachycardia, tremor, vasomotor symptoms became markedly increased, and the patient begged to discontinue the remedy.

One of the cases of Graves' disease which figure as being cured by the thyroid treatment was that of D. Owen.[32] This author discovered later, however, that his patient had all along taken the thymus instead of the thyroid gland. Thereupon the thymus was employed intentionally for this disease, by Owen himself, by Cunningham,[33] and by Mikulicz,[34] with favorable results. One patient of mine has been taking the raw thymus gland for the last twelve months; the exophthalmos, goitre, and some other symptoms are nearly entirely gone, but not the tachycardia. There is perhaps a reduction of ten to fifteen beats in a minute; however, the patient does not complain

of palpitation, nor in fact of any other subjective or objective symptom. The doses are the same as given in Goitre (which see).

ELECTRICITY.—The nervous symptoms and the prevailing theories of the nervous origin of Graves' disease early suggested the use of electricity as a therapeutic measure in this disease. The galvanic current has been and is still in general use. It deserves especial mention that there is no author who has tried the galvanic current and has not seen a more or less distinct improvement of the disease from its prolonged and judicious use. As to the mode of application, however, there is quite a variety of methods. One proposes to galvanize the cervical medulla, the other the sympathetic nerve, the heart, the goitre, and even the exophthalmos. The strength of the current employed has been usually not more than a few milliampères. Lately, however, there is an increasing tendency to employ stronger currents, and Rockwell,[35] who has seen in many cases very good results from his method, used in some cases as strong a current as 60 milliampères. Vigouroux[36] recommends highly the faradic current too, and Eulenburg[37] speaks favorably of franklinization and of electric baths. The unanimity with regard to the favorable effects of electricity in Graves' disease is, however, restricted to the use of the galvanic current. Moebius, who admits the favorable influence of electricity, believes, however, that this is only due to suggestion. The following contrast of opinions is interesting and instructive: Buschan,[38] who is an adherent of the nervous and a disbeliever in the thyroid theory of Graves' disease, is quite sure that electricity has an immediate effect, while he suspects that the good results of surgery might be due only to suggestion. Moebius, on the other hand, who is the originator and firm defender of the thyroid theory, is not in doubt at all about the reality of the surgical effects, but is quite sure that electricity means suggestion. *A propos* of suggestion, Audry[39] reports the case of a woman with Graves' disease complicated by hysteria, who became cured after she was made to believe that she was operated; and Brandenburg[40] speaks of a case of Graves' disease which became better in Lourdes.

Surgical Treatment.—The first operation upon the goitre in Graves' disease was performed by Tillaux[41] in 1880. It was thought at that time that he would have very few followers. However, we have at present on record about 200 cases of surgical treatment of our disease. The main increase falls on the last few years, as can be seen from the following data: Mannheimer[42] has collected, in 1894, 42 cases; A. Heydenreich,[43] in 1895, 61 cases; Buschan,[44] about the same time, 80 cases, and in April, 1896, F. Kinnicut[45] collected 187, and M. A. Starr[46] 190 cases. It must be stated that the increased surgical activity apparently was not due to improved methods or

improvement in the surgical technique or to the encouragement derived from an increasing number of good results. It seems to me rather that a strong belief of some surgeons in the thyroid theory stimulated them to their activity. If the manifold and varied symptoms of Graves' disease are caused by hyperthyreosis, by too much thyroid, then the removal of a great part of the thyroid will not only do away with the pressure-symptoms caused by the large goitre, but will also relieve the entire body from an intoxicating overdose of the thyroid. In looking over the various reports we find that those physicians and surgeons who adhere to the theory of hyperthyreosis are very much in favor of surgical treatment of Graves' disease, while those who believe in other theories are strongly against it. However, while I am on the one hand inclined to believe that the outcome of many operations in Graves' disease seems to support the theory that the disease is caused by a certain chemical function of the thyroid, I have on the other hand the positive impression that the results attained by the numerous operations tend to discourage their too frequent application in cases of characteristic Graves' disease. In the 190 cases collected by Starr there were 23 deaths due to the operation alone, which makes a little more than 12 per cent. mortality. This is a little higher than the average mortality of Graves' disease. While these operations, to say the least, did not improve the average mortality of the disease, they shortened life in 23 of the patients. Furthermore, there has hardly been an operation with a successful result which was not reported, while I am sure that many a fatal operation was performed which was not brought to record. Thorough statistics, I believe, would burden the record against the advisability of the operation. There is quite a striking contrast between the results of the operations upon the plain goitre and those upon the goitre of Graves' disease, and some writers believe that the cases with favorable results belong to the secondary form of Graves' disease, with goitre as a primary cause or at least a primary symptom. It seems that in some cases, at least, soon after the operation on goitre in Graves' disease a peculiar, mysterious process takes place. Even when the operation is performed with extreme care and with scrupulous asepsis, soon afterward the temperature of the patient becomes very high, and the pulse reaches 200 per minute; he may yet recover, or he dies in coma.

A friend[1] told me as long as ten years ago that a patient with Graves' disease in whom he had ligated the thyroid arteries had shown soon after the operation an extremely high temperature with a pulse of

[1] Dr. F. Kammerer. He informs me that he has since had another case with exactly the same course as in the first one; in this case the operation was done by resection.

200. We thought of the stimulation of the accelerating nerves and of a reflex upon heat-centres, and similar speculations. At that time there were as yet no such cases recorded. Some writers now try to explain the peculiar phenomena by assuming that the operation causes in some way or other a great flow of "thyroidin" by which the entire body becomes suddenly intoxicated. This extremely interesting fact shows us again that there is yet a good deal to be learned about the thyroid, and we had better wait for more facts before we prematurely attempt to thoroughly explain the few which have just come into our possession. These facts show us also the practical necessity of keeping our hands away from the thyroid gland unless there is an imperative indication for an immediate surgical interference. As to the method, Kocher considers the ligation of the thyroid arteries (only three) as the best one to be employed in operating upon the goitre in Graves' disease. Other surgeons, however, employ mostly resection. Poncet employs his new operative method of *exo-thyreopexie*, that is, the simple exposure of the thyroid gland. It would seem that this ought to be quite a harmless procedure, nevertheless Poncet lost one patient a few hours after the operation in the peculiar manner described above.

We should record here the statements of Hack,[47] B. Fränkel,[48] and others claiming that cases of genuine Graves' disease have been cured by local nasal treatment. Also the removal of a polypus of the uterus was sufficient, it is claimed, to "cure" a case of Graves' disease. Venesection in Graves' disease is a surgical measure of the past.

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DISEASES OF THE THYMUS GLAND.

THE thymus gland is situated in the upper part of the anterior mediastinum. It grows only during the first two years of life and remains stationary until about puberty, then as a rule it gradually degenerates, though there are exceptions of a persistent thymus. It is considered as a "ductless gland," though there is no secretion and the tissue is more of an adenoid character. With regard to the pathology of this gland there is not a single point which can be considered as settled. Cases of exudation and suppurative inflammation of the thymus were described, also tuberculosis, syphilis, and malignant tumors of the gland are mentioned. Such cases are at any rate very rare and surely secondary to some primary foci. There is no

reliable symptom by which a positive diagnosis of any of these diseases could be made *intra vitam*. Even at the post-mortem some writers were unable to distinguish between an abscess and normal degeneration of the thymus, or between a swelling of the gland or a cluster of swollen lymphatic glands. Laryngismus stridulus has been in former years ascribed to the swelling of the thymus gland; Friedleben[1] denied such a relation. Lately, however, we find again some authors connecting certain deaths of children under symptoms of spasmus glottidis with the hypertrophy of the thymus (Jacobi,[2] Biedert,[3] Pott,[4] Grawitz,[5] etc). Forensic medicine has cases of sudden deaths of adults on record in which an enlarged persistent thymus was found (Kob,[6] Seydel[7]). Such enlarged persistent thymus glands were also found in cases of sudden death while in the water (A. Nordmann[8]). The usual explanation of the connection between the enlargement of the thymus and the sudden death is to the effect that the enlarged gland is mechanically compressing the trachea and the nerves passing through the narrow aperture of the thorax. Other writers, however, see in the enlargement of the thymus gland only a part of a "status lymphaticus" (Paltauf,[9] Escherich[10]).

We will do no harm to our patients if we admit the possibility that an enlarged thymus is sometimes the sole or a contributing cause of a dyspnœa, especially when the percussion of the upper part of the sternum reveals dulness. In such cases the application of an ice-bag over the sternum or of leeches to the jugulum, or the administration of a purgative might relieve the hyperæmia of the gland and diminish the pressure. We should also bear in mind to avoid the much-feared bending of the head backward (Seydel), especially during the operation for tracheotomy. We should be provided with a long flexible (metallic) tracheotomy-tube in case the usual tube either does not reach or does not pass the obstruction in the trachea. Escherich[11] suggests the feeding with large doses of thymus. Of course, there can be no proper therapy where there is no pathology.

The thymus gland of the animal has lately become important in many practical respects. In physiological chemistry and bacteriology it is used largely on account of its richness in nucleo-proteids. Baumann[12] discovered in the thymus the presence of small quantities of iodine. The thymus gland of the lamb and the calf has lately been employed with good results in the plain goitre and in Graves' disease.[13] On myxœdema the thymus has no effect at all (v. Eiselsberg,[14] Firbass,[15] Escherich[16]). Cunningham,[17] however, has seen some alleviating effects of the thymus upon thyroidless dogs.

Of the function of the thymus gland we have not the slightest knowledge. We cannot fail, however, to note the very recent experimental reports of Abelous and Billard.[18] They have removed the

thymus in frogs and state that the animal shows great fatigue; its green color soon becomes changed, and the blood becomes hydræmic. By grafting the thymus of another frog in the abdomen of the thymus-less frog all the symptoms disappear. The future will show how much there is in this important statement.

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OBESITY.

Definition.—By obesity we designate an abnormal accumulation of fat in that tissue which in the normal condition contains a moderate amount of fat—namely, the connective tissue, or rather the connective-tissue cells. This definition distinguishes obesity from fatty degeneration, which means the presence of fat in tissues which normally do not contain fat at all, or contain it in extremely small quantities like epithelium, muscle-fibres, etc. Both states occur independently of each other, though obesity may lead also to fatty degeneration, especially of the heart-muscle. The abnormal appearance of fat in the animal body is due, as I believe, to a disturbance in its metabolic processes. We shall therefore preface our remarks on the treatment of obesity by a short discussion of some of the laws governing the normal process of metabolism.

Some of the Laws of Metabolism.—The manifestations of animal life mainly consist in two forms of kinetic energy, heat and

motion. The source of this energy is to be found in tissues of the body like the proteids, fat, and carbohydrates (glycogen of the liver, muscle, etc.). Their high complex molecules represent a considerable amount of potential energy. By the dissociation of these molecules and subsequent oxidation to simpler products the potential energy becomes converted into kinetic, the tissues burn up and liberate energy. The final products of the oxidation are water, carbon dioxide, and urea. If an animal be starved, then the continual liberation of energy will be derived from the body-material itself, all tissues contributing toward the expenditure, though not in the same proportion. However, by introducing into the body the very same substances (proteids, fats, and carbohydrates) as food, the body-tissue will be spared, and it depends upon the amounts of these food-stuffs whether the body shows a metabolic equilibrium, a deficit, or a surplus. This is all very simple; but there has been a great deal of interesting work done on the relation of the different foods to the different body-tissues.

At first the simple teaching prevailed that each kind of food attends to the corresponding tissue, *i. e.* the proteids of the body are supported by the ingested proteids, the fat is derived from the fat of the food, etc. Liebig, however, soon demonstrated that animals can be fattened by being fed with carbohydrates alone, and that the fat of the milk in a cow largely exceeds the amount of the ingested fat; and furthermore that the fat of any animal differs in character from the fat of the food it receives. Liebig, then, came to the conclusion that the carbohydrates are the only source for the production of fat in the animal body, and that the ingested fat is never deposited as fat-tissue. This opinion was dominant for many years until Voit and Pettenkofer came out with their theory that the fat of the body is largely derived from the ingested proteids. According to their accounts the nitrogen found in the excreta, especially in the urea, shows the decomposition of a larger amount of proteids than would correspond to the quantity of carbon present in the excreta, and concluded therefrom that a part of the ingested proteids are decomposed into non-nitrogenous products which are retained in the body as fat. The carbohydrates, according to their view, have to do with the formation of fat only in so far as they serve as a ready source of the liberation of energy, thus protecting the non-nitrogenous products of the decomposing proteids from being oxidized to the final products of CO_2 and H_2O. Voit and Pettenkofer strengthened their view by satisfactory experiments and enlisted in their support the fact of the fatty degeneration of proteid tissue like epithelium, muscle-fibres, etc. Pflüger, however, has shown that there was quite an error in the calculations upon which this theory was based, and that none of their experiments

offered a conclusive proof that fat is directly formed from proteids. We mention here these theories because several of the methods of dietetic treatment of obesity which are still in vogue are based upon these different theories of the origin of fats in the animal body.

The following view of the final fate of the ingested food-stuffs within the animal body might be considered as the one at present entertained by all physiologists (except, of course, by those who are still engaged in the defence of a special theory): The ingested proteids are partly utilized as "tissue-proteid," *i. e.* the deposition of the unchanged nitrogenous material in the body-tissue either to supplant the wasted proteids or to add new proteid tissue required to accomplish the growth or the hypertrophy of the body-organs; partly the ingested nitrogenous foods are stored up in the tissue-spaces as "circulating proteids," being there in readiness to meet several requirements. It might protect for some time, in case of starvation, the proteid tissue of the organ from being wasted; it might immediately become decomposed and oxidized to the final waste-products of the proteids, *i. e.* urea, carbon dioxide, and water, thus converting the stored-up potential energy into heat and labor; finally, it might split up into a non-nitrogenous product and be stored away in some of the body-tissues as glycogen. Of fat we now know by the experiments of Lebedoff and I. Munk that under certain conditions the ingested fat can be deposited unaltered in the fat-cells; thus the fat of a dog fed by mutton tallow had a greater similarity to this fat than to the kind of fat usually found in dogs. However, this takes place only under extraordinary conditions; under normal circumstances it is probable that all the ingested fat is burnt up into CO_2 and H_2O, thus providing the body with a considerable amount of kinetic energy. Of the ingested carbohydrates one part is stored up as such in the body (sugar in the blood, glycogen in the liver, epithelium, etc.); another part is utilized for the maintenance of the energy of the body by becoming oxidized to CO_2 and H_2O, a process which the carbohydrates can undergo with readiness, as H_2O exists already, so to say, in a preformed state in its molecule. Finally, a third part of the carbohydrates becomes converted into fat, which is stored away in the body. It seems that under normal conditions the carbohydrates form the sole origin of the fat-tissue of the body. We may also admit that the proteids contribute to the accumulation of fat, but only in an indirect way, by the conversion of the glycogen coming from the proteids into tissue-fat. However, it seems that the contributions from this source form only a small factor in the formation of the body-fat.

From the foregoing statement it can be seen that the services rendered by the three kinds of food-stuffs to the maintenance of the ani-

mal life consist exclusively (except the fraction utilized for "proteid tissue") in the creation of energy liberated by the process of decomposition and oxidation, by the combustion of the ingested food-stuffs within the body. The amount of energy thus derived from the metabolic combustion of the food-stuffs within the body is exactly equal to the energy liberated by the combustion of the same stuffs outside of the body. The energy developed by the outside combustion consists, of course, in the form of heat. We measure this kinetic energy by calories, that is by the amount of heat required to increase the temperature of one cubic centimetre of water one degree C. This is a small calorie. By a large calorie is meant the quantity of heat required to elevate the temperature of one kilogramme of water one degree C. Each of the food-stuffs has a constant quantity of energy —combustion equivalent—which has been determined by many investigators. One gramme of proteid yields about 4.1, one gramme of carbohydrates about 4.1, and one gramme of fat yields 9.3 large calories. When we know the quantities of the three stuffs taken in twenty-four hours, we also know how much energy or how many calories were offered to the body. But this does not tell us the exact amount of combustion which has actually taken place, as not all the consumed food is digested and absorbed. Therefore other methods have been devised to determine the number of calories yielded by the ingested food-stuffs within the body.

There are at present two methods employed for this purpose. One is to determine directly the amount of heat the animal body develops in twenty-four hours. The other method is to determine the amount of nitrogen and carbon excreted in twenty-four hours, and thus the exact amount of food-stuff which was actually combusted in twenty-four hours can be calculated. By determining the N and the C found in twenty-four hours in all excreta (including fæces, etc.) and comparing it with the food partaken in twenty-four hours it can thus be established whether there has been as much expenditure as income (nitrogen- and carbon-equilibrium); or whether more combustible material was ingested than expended, the body storing up the balance; or whether, finally, more material was burnt up than ingested, the body consuming its savings or touching the capital.

The ingestion of food (and inhalation of oxygen) constitute the income, and the muscular exertion and heat-production are the expenditure of the body. Less income or increased expenditure, or both, cause waste; more income or less expenditure, or both, cause obesity.

Etiology.—At present the prevalent opinion is that the chief cause of obesity is to be found in chronic hyperfeeding, *i. e.* the patient partakes constantly more food than he requires for keeping up

the metabolic equilibrium of his body, and the result is that a surplus of the ingested food is stored away in the body, mainly as fat. This implies that the metabolic function of the body is exactly the same in obese as in non-obese individuals. Obesity, then, is not a disease, just as general waste of the body due to starvation cannot be considered as a disease. It seems to me that this conception of the cause of obesity certainly cannot hold good for all the cases of abnormal accumulation of fat in the body. It should be remembered that there are many individuals with striking obesity who are living on only an average diet belonging to the individuals of their height, age, and mode of activity. Further, it is quite certain that one and the same excessive diet leads in one person to a weight, say, of 250 lb., and in another, to a weight, perhaps, of 350 lb. On the other hand, there are persons who habitually consume quantities of food far above those assigned to the "average diet" without gaining by it any abnormal amount of fat. In fact, with some thin persons we can never succeed in making them gain flesh by any amount of overfeeding. In these classes the metabolic equilibrium is apparently independent of the quantities of the ingested food-stuffs. Again, in many cases of obesity, heredity is quite a pronounced factor. Not only that obesity is present in a number of members of the same family, but in many of them the obesity sets in at about the same age. We certainly cannot assume that at a certain age they begin to consume more food. In such cases the obesity is spoken of as a constitutional disposition. Further, the fact that the female sex shows a greater aptness to obesity is surely not sufficiently explained by their diminished activity. Then, obesity in the female sex often sets in after parturition, even without lactation, or with lactation, but especially so with the cessation of the menstrual flow. Here the increase of fat is apparently not due alone to an increase of income of food, or decrease in expenditure. But, above all, the following two well-established facts seem to be quite significant for the question of the origin of obesity: (1) Castration gives rise in both sexes to the development of fat in animals and man. (2) Feeding with thyroid reduces obesity in man and animals. Here we see that the simple removal of a gland causes the accumulation of fat, and that the introduction of the substance of another gland into the body causes the disappearance of fat; in other words, the presence or absence of a surplus of fat in the body is due, in these cases at least, to the absence or presence of some gland-tissue in the body and in a measure independent of the amount of the ingested food. Taking all these and similar other points in consideration, I arrive at a different conception of the origin of obesity, which is, briefly stated, as follows:

The normal metabolism of the body stands under the care of an

agent or rather of agents who supervise the proper distribution of the ingested and absorbed food-stuffs among the several functions of the metabolic process. There is an agent which guards the conversion of carbohydrates, especially of the glycogen of the liver, into sugar, normally carried in the blood, which is not to exceed 0.2 per cent. There is another agent stationed in the thyroid gland guarding against the formation and accumulation of myxœdematous tissue. Further, there is probably an agent, whose character and domicile we as yet do not know, but whose task it is to prevent the retrogressive metabolic products of the proteids from being deposited as uric acid in the tissues of the body. And there is, I suggest, an agent whose task it is to permit only a small part of the body's income to serve as a deposit in the fat-cells. With all the agents doing their duty there is a physiological, harmonious working of the machinery of the metabolic process : no matter how much sugar is ingested, no diabetes will come; no matter how much proteid is absorbed, no arthritic diathesis, no gout need appear; and probably, no matter how much food is consumed, there need not be any obesity. However, if the glycogenic agent is lax in the performance of his duty, large amounts of ingested glucose will force the entrance of some sugar into the blood, causing temporary glycosuria, and if the agent is entirely absent from his post, then even small amounts of ingested carbohydrates find their way unchecked into the blood and cause the condition known as diabetes. We believe that the same applies to the condition known as obesity. If the agent guarding against the conversion of the body's combustion-material is doing its duty carelessly, an overflow of the body with combustion-material—by overfeeding—will cause a deposition of fat in the connective-tissue cells; but if the agent is entirely off his post, then even an average diet will gradually lead to obesity. The tendency of the fat-cells to take the body's food differs favorably from the other metabolic disorders, as it only drains upon the surplus of the combustion-material and readily returns its savings when the body is in need of material—when it is in a starving condition. On the other hand this metabolic disorder is guarded against, it seems, least of all; therefore overfeeding leads in quite a large number of cases to obesity, the proportion being here apparently larger than in the production of cases of temporary glycosuria by the consumption of too much sugar. The agency against the myxœdematous degeneration seems to be the best-guarded post in the metabolic functions.

We know as yet very little of the real nature of the agent guarding against lipomatosis, but it seems that we already know something about the glands serving as domiciles for our agents, and, after all, this kind of information is all we possess of the agent guarding against myxœdema or the agent controlling the production and distribution

of sugar. It is just our knowledge of the latter agent which might serve us as an instructive instance. Von Mering and Minkowski discovered that the total removal of the pancreas produces diabetes; this important fact is now well established. Now the pancreas, besides controlling the production of sugar by "internal secretion," has other well-known functions. Again, even if the sugar-controlling function of the pancreas be perfectly intact, diabetes can be produced by other known and unknown agents. We learn here two important facts: That one and the same gland can attend to two or more separate functions, and that one function can be attended by two or more agents. As to the over-production of fat, we have seen that the feeding with thyroid gland reduces lipomatosis and prevents the re-accumulation of adipose tissue. The thyroid gland, then, secretes, besides the substance preventing a myxœdematous degeneration, also a substance assisting in the prevention of abnormal formation of fats. On the other hand, the removal of the generative organs is often the cause of the deposition of much fat in the body. This looks as though these organs, besides attending to their well-known function, assist by some "internal secretion" in keeping down the tendency to obesity. There is nothing in the way of assuming that some more organs participate in a larger or lesser degree in the same task.

This is not the place to dwell much longer on the particulars of this theory; I wish only to emphasize with a few words its main points. The normal course of the metabolic processes of the body is guarded and controlled by factors furnished by the "internal secretion" of some or all of the glands of the body. This applies also to the deposition of the proper amount of fat in the body. The abnormal accumulation of fat indicates a disturbance of function, a diminution or entire suspension of activity of one or more of the controlling factors. Obesity, then, is a disease caused primarily by a disorder in one of the links of the metabolic chain; the consumption of too much food is only the external cause of the condition.

Extent and Course.—As a moderate deposition of fat in some parts of the body must be considered as normal, it is impossible to draw a distinct line between the normal and abnormal accumulation of adipose tissue, at least in moderate cases of obesity. For practical purposes we may accept a certain standard of weight for a certain height and age, and then consider an addition of 20 per cent. of weight as being yet within normal. We might also be guided by the amount of inconvenience the obesity is causing the patient; this, however, varies within a wide range. I know a patient who bitterly complains of the annoyance her fat is causing her at a weight of 170 pounds, and I know another one who has no complaint to make whatsoever at a weight of 330 pounds. We should also remember that

many of the complaints, especially of our female patients, are prompted not by bodily discomforts, but by so-called æsthetical conceptions, which vary not only with continents and races, but also with individuals. The amount of fat which can be deposited in some obese individuals seems to be enormous, and often considerably exceeds the weight of all the other tissues of the body taken together. The Fat Men's Club in New York counts many members whose weight exceeds 300 pounds. An actor in Dresden, Nicolini, weighed 560 pounds; when he knelt on the stage a valet had to help him to get up.[1] E. Bright, an Englishman, weighed 616 pounds.[2] Kisch quotes Wadd as an authority for the statement that there was a man in New York who weighed 1100 pounds.

Obesity in its moderate degrees can be borne by the patient without much inconvenience and does not lead to serious disturbances in any of the functions of the body. Higher degrees of obesity, however, are usually of great annoyance to the patient and earlier or later cause serious effects which will eventually endanger life. The patient is short of breath, fatigues easily, perspires at the slightest provocation. There is often present a certain laziness of the body combined with sluggishness of mind. Fat gradually infiltrates the tissue-spaces between the muscle-fibres, covers thickly the heart, largely accumulates in the liver, lowering the blood-pressure of the entire body and causing congestion within the portal system, with their consequences of œdema, albuminuria, hæmorrhoids, etc. It leads also to sterility, to premature amenorrhœa, to loss of the sexual instincts, and to impotence. The constant excessive drain upon the nutritive fluids of the body combined with the impaired intestinal absorption leads to a diminution of the proteids of the body and of the blood, and the impaired respiration and circulation do not provide the hæmoglobin with a sufficient amount of oxygen, thus causing a constantly progressing anæmia. This in turn leads further to arteriosclerosis, fatty degeneration of the kidney-epithelium and of the muscle-fibres of the heart—and to sudden death from cerebral apoplexy or from paralysis of the heart.

Treatment.

The chief measure for the reduction of the surplus amount of fat is the regulation of the diet, or rather its reduction. This is, of course, in perfect accord with the prevailing view that too much eating is the only cause of the too much fat. For the theory that obesity is primarily a functional disease of the metabolism, the regulation of the diet has the value only of a symptomatic treatment,

[1] Froelich, *Eulenberg's Real-Encyklopädie*, 2 Aufl., Bd. vi. S. 455.

[2] *Phil. Trans.*, vol. xlvii. p. 188.

while the main object of the therapy should be the administration of a remedy for the re-establishment of the disturbed function. We must acknowledge that we do not possess such a remedy. However, our efficient treatment of the other diseases of metabolism, like diabetes and myxœdema, is, after all, not more than a symptomatic one. The most efficient treatment of diabetes is the withholding of carbohydrates, and the only treatment of myxœdema is the increase of the expenditure by the administration of the thyroid. In both cases the disease returns when the treatment is discontinued. In the treatment of obesity we are even more favorably situated, inasmuch as we are in a position to influence the income as well as the expenditure, as we shall see presently.

As just said, the regulation of the diet, the methodical and strict supervision of the amount and character of the patient's food, has always been and is still the chief aim in treating obesity. There are quite a number of specified bills of fare for the diet of obese patients; they were made up by different writers according to the views they held with regard to the origin of the formation of fat in the animal body. These bills of fare are frequently termed "cures." Three of these "cures" are best known and are quoted by all writers on obesity. They are Banting's cure, Ebstein's cure, and Oertel's cure. We shall describe them here briefly.

Banting's Cure.—William Banting was an obese gentleman who followed out a certain diet prescribed for him by his physician, William Harvey. He was so much pleased with the result of his diet (he lost 35 pounds) that he described it in an open letter for the benefit of the public.[1] His bill of fare is as follows:

Breakfast.—Four or five ounces of beef, mutton, kidney, broiled fish, bacon or cold meat of any kind except pork; a large cup of tea (without milk or sugar), a little biscuit, or one ounce of dry toast.

Dinner.—Five or six ounces of any fish except salmon, any meat except pork, any vegetable except potato, one ounce of dry toast, fruit out of a pudding, any kind of poultry or game, and two or three glasses of good claret, sherry, or Madeira (champagne, port, and beer forbidden).

Tea.—Two or three ounces of fruit, a rusk or two, and a cup of tea without milk or sugar.

Supper.—Three or four ounces of meat or fish, similar to dinner, with a glass or two of claret.

For a "Night-cap," if required.—A tumbler of grog (gin, whiskey or brandy, without sugar) or a glass or two of claret or sherry.

We see that this bill of fare permits plenty of meat and fish, is also quite liberal with alcohols, but cuts down carbohydrates and avoids especially fat. It is evident that it was built up upon Liebig's

[1] *A Letter on Corpulence, Addressed to the Public.* London, 1863.

conception of the origin of fat. This diet has been largely employed and with quite satisfactory results, *i. e.* as far as the obesity is concerned; but it aroused also quite an extensive opposition on account of the many harmful effects which this sort of diet, so it is claimed, produces: It destroys the digestion, it produces general weakness, it leads to arthritis, it favors the development of tuberculosis (?), it leads to insanity, and it has been the cause of many deaths.

EBSTEIN CURE.—The diet which was recommended by Ebstein for the reduction of obesity is quite the reverse of the Banting cure. It is as follows:

Breakfast.—One large cup of black tea, about 250 grammes, without milk or sugar, 50 grammes of white or toasted brown bread, with plenty of butter. (In winter about 7.30, in summer about 6 or 6.30 A. M.)

Dinner (between 2 and 2.30 P. M.).—Soup, often with marrow, from 120 to 180 grammes of roasted or boiled meat, vegetables in moderation, leguminous preferably, but also cabbages. Owing to their saccharine ingredients, turnips were almost and potatoes altogether excluded. After dinner a little fresh fruit when obtainable. As *compote:* Salad or occasionally some stewed fruit without sugar. *Beverage:* Two or three glasses of light white wine. Immediately after dinner a large cup of black tea without sugar or milk.

Supper (from 7.30 to 8 P. M.).—In winter almost invariably, in summer occasionally, a large cup of black tea without milk or sugar. An egg or a slice of fat roast beef, or both, or some ham with its fat; Bologna sausage, smoked or fresh fish, about 30 grammes of white bread well buttered, eventually a little cheese and some fresh fruit. Sugar, sweets of all kinds, and potatoes are forbidden.

Ebstein cuts down meat and reduces also carbohydrates, but allows quite large quantities of fat. Ebstein came out with his plan of diet a year or two after the publication of Voit's treatises on metabolism, and he was apparently influenced by the theory of Voit that the proteids contribute largely to the formation of fat. Ebstein's partiality for fat in the food is caused by the idea that fat satisfies the appetite better than proteid and carbohydrates, and that a person who partakes of fat requires a smaller amount of food. It is claimed by some writers that the reduction of obesity accomplished by Ebstein's method is due to the dyspepsia caused by the ingestion of too much fat. It deserves, however, to be especially pointed out that so far no other objection has been raised against the Ebstein cure.

OERTEL CURE.—Originally Oertel's diet was arranged for the treatment of cardiac troubles, but, noticing the loss of weight in the patients so treated, Oertel applied his diet also to the treatment of all cases of obesity. It is as follows:

Breakfast.—50 grammes of wheat bread; 130 c.cm. of coffee; 20 c.cm. of milk, and 10 grammes of sugar.

Dinner.—Soup 150 c.cm.; 200 grammes of stewed beef; 100 grammes of vegetables, 50 grammes of salad, 100 grammes of dessert made of flour, 50 grammes of black bread, and 125 c.cm. of Pfalzwein.

Afternoon.—130 c.cm. of coffee, 20 c.cm. of milk, and 10 grammes of sugar.

Supper.—One soft-boiled egg, 150 grammes of fried meat, green salad 50 grammes, a roll of 50 grammes, Pfalzwein 250 c.cm., and water 250 c.cm.

The amount of proteids and carbohydrates of the Oertel diet exceed those of the other two bills of fare, while the amount of fat is less than in the Ebstein and more than in the Banting diet. The main feature of the Oertel cure is the considerable reduction of the fluids which the patient is allowed to take. This, however, is by no means original with Oertel. Some twenty years before Oertel adapted it for his diet, Dancel recommended the restriction of the drinking of water as a chief means for the reduction of fat. Oertel's cure aroused quite a lively opposition from many quarters; it is claimed by some writers that it is a dangerous procedure which has caused some deaths.

The fact that a reduction of fat was accomplished by each of these three methods of treatment shows that the success does not depend so much upon the reduction of a special food as upon the reduction of food in general, this reduction being quite considerable in all the three methods, as we shall see presently.

We have seen above that the value which the food has for the body is measured by the calories it represents. By a large number of experiments it was established that the "average diet" of an adult of medium size, in order to maintain the metabolic equilibrium, has to represent about 3000 calories. The "average diet" compounded by Voit is as follows: Proteids 118, fats 56, carbohydrates 500 grammes. This is equal to about 3054 calories. The proportion of the different foods to one another can be varied considerably, but the final sum must represent about 3000 calories. Let us now calculate the calories which are represented in the three diet-cures for twenty-four hours:

	Proteids.	Fats.	Carbohydrates.	
Banting	172 grammes	8 grammes	81 grammes	= 1112 calories.
Ebstein	102 "	85 "	47 "	= 1401 "
Oertel	183 "	38 "	143 "	= 1690 "

We see that in these diet-plans the number of calories is cut down to about one-half, in Banting even to one-third, of the number re-

quired for the normal "average diet." The "cures," then, mean practically, wasting away of the body by starvation.

At present these cures are no longer followed out so strictly, inasmuch as every "specialist" on obesity is devising his own bill of fare, but the basis of all these diet-cures still is the considerable reduction of the daily food. For instance, the diet-plan which was devised by Kisch of Marienbad, for the so-called plethoric obesity, contains about 178 grammes of proteids, 11.3 grammes of fat, and only 80 grammes of carbohydrates for twenty-four hours, which is equal to only 1081 calories. When we consider that some of the patients are used to a diet about twice as large as the normal one, this reduction would mean one-sixth of the patient's former diet.

According to Hirschfeld, during these cures the amount of nitrogen found in the excreta collected for twenty-four hours exceeds the quantity of nitrogen contained in the food partaken in that time. This means a constant loss of body-proteids, and must finally lead to a serious condition. Von Noorden and Daber, however, dispute the correctness of this statement. However this may be, for various reasons we shall not advocate here those dietetic plans of treatment which prescribe such a large and abrupt reduction of the food of the obese patient. The obese condition, though a pathological one, had a gradual development, and the metabolic mechanism gradually adapted itself, to a certain degree, to the new circumstances. Any radical and abrupt change is liable to work like a shock and bring on an irreparable disturbance in the equilibrium. Then, such radical, unbearable measures will not be carried out by the patient for any length of time, and he will soon fall back into his old habits: that is how the patients who leave Carlsbad gain in the first week a good part of the fat they lost there; they are glad, as they say, to have a good meal again. Neither is such rapid and radical reduction necessary; the endangering and annoying symptoms are already relieved by a loss of only a few pounds, which can be attained in quite a short time by a moderate change in the food. The balance of the fat can be finally reduced by a gradual and slow increase in the reduction of the food; thus the patient's habits in eating will undergo a slow but sure change with less prospects of a relapse. The metabolic mechanism, too, I believe, will regain more resisting power against a new overflow of nutritive material by a gradual re-adaptation to the original working of the normal mechanism. The different behavior of the fat-cells under slow and rapid reductions seems to me quite significant. When the reduction takes place gradually, the fat leaves the cell little by little, and the membrane shrinks around the remnant; when all the fat is gone, the cells regain the appearance and behavior of a normal connective-tissue cell. In rapid reductions the fat leaves the cell rap-

idly, and the vesicle becomes filled with serous fluid—the so-called serous fat-cells. It is not impossible that such a distended cell exerts a greater mechanical (or chemiotactic?) attraction upon the surrounding fat-forming nutritive material.

A conservative plan of dietetic treatment of obesity has been put forward quite recently by E. Pfeiffer. He recommends that the first reduction of food should be arranged upon the basis of a "maintenance diet" (*Erhaltungskost*)—*i. e.* such a diet as is required to maintain the metabolic equilibrium of the average weight of a normal body of a certain age and height. The average weight which is to be expected at a certain age and height can be found in the well-known table of Quetelet (Table I.):

TABLE I.—*Quetelet's Table, showing Expected Weight at a Given Age and Height.*

	Men.		Women.			Men.		Women.	
Age.	Height in Meters.	Weight in Kilos.	Height in Meters.	Weight in Kilos.	Age.	Height in Meters.	Weight in Kilos.	Height in Meters.	Weight in Kilos.
0 . . .	0.5	3.2	0.49	2.91	13 . . .	1.44	34.4	1.40	32.9
1 . . .	0.7	0.45	0.69	8.79	14 . . .	1.49	38.8	1.45	36.7
2 . . .	0.77	11.34	0.78	10.67	15 . . .	1.55	43.6	1.49	40.4
3 . . .	0.86	12.47	0.85	11.79	16 . . .	1.59	49.7	1.54	43.6
4 . . .	0.92	14.23	0.92	13.00	17 . . .	1.63	52.9	1.56	47.3
5 . . .	0.99	15.77	0.98	14.36	18 . . .	1.66	57.9	1.56	51.0
6 . . .	1.05	17.24	1.10	16.01	20 . . .	1.67	60.1	1.57	52.3
7 . . .	1.11	19.10	1.15	17.54	25 . . .	1.68	62.9	1.58	53.3
8 . . .	1.16	20.76	1.18	19.08	30 . . .	1.68	63.7	1.58	54.3
9 . . .	1.22	22.65	1.19	21.36	40 . . .	1.68	63.7	1.58	55.2
10 . . .	1.28	24.52	1.25	23.52	50 . . .	1.67	63.5	1.53	56.2
11 . . .	1.33	27.1	1.30	25.7	60 . . .	1.63	62.9	1.52	54.3
12 . . .	1.39	29.8	1.35	29.8	70 . . .	1.62	59.5	1.52	51.5

For instance, if a man of forty and a height of 168 cm. weighs 100 kilos, we know by Quetelet's table that his normal weight should be about 64 kilos. Forty-five calories is about the food-value required as an average diet for each kilogramme of the body's weight. When we now multiply 64 by 45, we find that the food of our patient must represent 2880 calories. These calories we can distribute between the food-stuffs in the proportion of proteids 17, fat 8, carbohydrates 72, and we then have the "maintenance diet" of this patient. In this manner we can easily ascertain to what quantities we have to reduce the food of all obese patients. If under this diet no reduction takes place, Pfeiffer recommends in the first place to increase the proteids at the expense of fat or carbohydrates, but so as to keep up the normal number of calories. If, then, there is still no reduction, or the reduction is too small, a reduction of the calories must be instituted

by cutting down the carbohydrates by 50 to 100 grammes a week, thus gradually approaching the Ebstein cure.

Pfeiffer's method, conservative and commendable as it is, still has the disadvantage of starting the change with too great an abruptness in many cases of obesity. When the patient, indeed, has been in the habit of eating a good deal, perhaps twice as much as his "average diet," which is by no means a very rare occurrence, the "maintenance diet" will mean for him a sudden reduction to one-half of his usual food. The objections which I raised above against the rapid reductions in the other methods also hold good against the rapid changes occurring when treating by Pfeiffer's method. I also believe that a reduction of 400 calories a week is rather too great when the diet is already below the average: in four weeks the diet will be less than one-half of the normal.

For these reasons I propose to modify Pfeiffer's method in some respects.

In every case of obesity we should try to ascertain the quantities of food our patient is in the habit of partaking. A reduction not exceeding 400 calories should then be established for the first week; and each week the reduction should be increased by about the same amount until the line of the maintenance diet is reached. Below this line the increase in reduction must not exceed 100 calories a week, and must not go below two-thirds of the average diet. A reduction below the maintenance line should be undertaken only to meet serious disturbances or annoyances, while the reduction of the diet, as long as it is above the average line, might be instituted for less serious reasons, for a diet above the average is an abnormality in itself. Further, it should be ascertained in which kind of food the obese patient is most in the habit of indulging, and just this food should be reduced most, as there is possibly a causal connection between the indulgence in the special food and the increase of the adipose tissue. When there are no special preferences, the reduction should be distributed, as long as the diet is still above the average, between the food-stuffs in the proportion usually present in the average diet (17 : 8 : 72). When already below the average diet the reduction should be confined mainly to carbohydrates, as the main source for the formation of fat, while the proteids should rather undergo a moderate and gradual increase in order to meet an eventual excess of the excretion of nitrogen. While undergoing a food-reduction below the average diet, the strength, heart, urine, etc., should be watched closely, and the treatment interrupted at the first signal of a serious disorder.

The management of this treatment might appear to be more complicated than it really is. I append a table (Table II.) which shows

the percentage of the proteids, fat, and carbohydrates in most of the articles of food which are in use:

TABLE II.—*Percentage of Proteids, Fats, and Carbohydrates contained in the most important Food-stuffs.*

	Proteids.	Fats.	Carbo-hydrates.
I. ANIMAL FOOD-STUFFS.			
Beef (raw)	21.39	5.19	
Beef (cooked)	37.73	9.15	
Beef (fried)	32.21	7.81	
Veal (raw)	18.88	7.41	
Mutton (raw)	18.11	5.77	
Pork (raw)	19.91	6.81	
Ham (salted)	22.32	8.68	6.38
Hare (raw)	23.34	1.13	0.19
Venison (raw)	19.77	1.42	1.24
Liver-sausage	15.93	26.33	. .
Chicken	19.72	1.42	
Duck	22.62	3.11	
Codfish (fresh)	17.09	0.35	
Salmon (fresh)	13.10	4.57	4.67
Mackerel	18.80	8.20	
Pike	20.11	0.69	0.92
Oysters	8.00	13.00	1.50
Liver	19.59	5.60	1.10
Bacon (salted)	9.72	75.75	
Eggs	12.55	12.11	0.55
Milk	3.31	3.66	4.92
Cheese (fat)	27.16	30.43	2.53
Cheese (lean)	32.65	8.41	6.80
Butter	0.86	83.11	0.70
II. VEGETABLE FOOD-STUFFS.			
Wheat bread	9.60	1.00	60.10
Rye bread	8.50	1.30	52.30
Potatoes	1.79	0.16	20.56
Carrots	1.04	0.21	9.40
Turnips	0.96	0.16	5.98
Radishes	1.23	0.15	3.79
Asparagus	1.98	0.28	2.74
Peas (green)	5.75	0.50	10.86
Beans	2.77	0.14	7.02
Cauliflower	2.53	0.38	5.01
Winter-cabbage	3.99	0.90	11.63
Cabbages	2.50	0.50	4.0–6.0
Spinach	3.15	0.54	3.34
Mushrooms	2.57	0.13	4.76
Cucumber	1.02	0.09	2.28
Lettuce	1.41	0.31	2.19
Sugar	. .	. .	96.73
Honey	1.29	. .	81.44
Apples	0.39	. .	12.90
Pears	0.36	. .	11.80
Plums	0.40	. .	8.24
Cherries	0.62	. .	11.15
Grapes	0.59	. .	15.32
Berries	0.50	. .	7.00
Walnuts	16.37	62.86	7.89
Chestnuts	5.48	1.37	38.34
Beer	0.49	. .	4.55
Brandy	. .	. .	69.50
White wine	. .	. .	11.82
Sherry	. .	. .	22.36
Champagne	. .	. .	11.95
Coffee	0.16	0.50	1.40
Tea	0.30	. .	0.60
Thin soups	1.10	1.50	5.70

Knowing that each gramme of proteid is equal to 4.1 calories, a gramme of fat 9.3, and 1 gramme of carbohydrates 4.1, and knowing by the Food-table the amount of proteid, fats, and carbohydrates contained in each article, we can easily compound a diet which shall represent a certain number of calories. In the beginning of the treatment it will be better to have the patient weigh exactly the food which he is to take. Later on he will have learned to estimate the weight of a certain piece of food by its apparent size, and a certain measure of laxity might be overlooked.

With regard to *drinking*, as far as it refers to water, no great restrictions should be made. It seems now to be the opinion of the majority of observers that the reduction of water might lead to a

reduction of the body but not of its fat. A reduction to less than 1000 c.cm. in twenty-four hours is even harmful, as the kidneys might become irritated. However, in cases of obesity combined with dropsy, a reduction of fluid is rather advisable, especially when the patients were in the habit of consuming large quantities of water. Alcoholic beverages might be taken in small quantities as long as their caloric value is taken into account. However, it should be remembered that according to Miura alcohol causes a greater decomposition of proteids in the body and that it leads to fatty degeneration of certain tissues.

Saline purgatives have been and are still greatly in use in the treatment of obesity. Their fat-reducing effect, if they have any, might be due to the premature removal from the intestinal canal of a part of the food which, were it permitted to remain longer, would finally have been digested and absorbed; the effect then amounts practically to a food-reduction, the extent of which remains unknown. It might perhaps affect the weight of the body also by the withdrawal of a quantity of fluid. It is a fact that obese patients are sent to Carlsbad, Marienbad, Kissingen, etc., where they indeed often lose quite a great deal of their weight within a short period. But the strict diet the patients are put upon in these places amounts sometimes only to one-third of the average diet, and Seegen and others insist upon, and claim to have shown it by experiments, that the use of the minerals without the diet has no reducing effect upon obesity. However, my own impression is that the effect often varies with the individual: in some cases we see a distinct reduction running parallel with the administration of the minerals; in some other cases, again, there seems to be no effect or rather some small increase in weight following the frequent use of mineral laxatives; the loss in these cases is probably being compensated or even over-compensated by the improvement of the digesting and absorbing powers of the cleansed digestive canal. My own policy is to permit the liberal use of bulky carbohydrates like salads, etc., which satisfy the appetite by virtue of their large mass, and then advise the frequent use of Carlsbad salts for the purpose of the early removal of the cellulose, etc.

Next to the reduction of the diet, *an increase of the expenditure* should be greatly encouraged. This is accomplished in the first place by an extended muscular exertion, which is in itself an expenditure of energy; then it increases the heat-dissipation, and finally it increases the number of the respirations and cardiac beats, by which increase more oxygen is brought to the blood and to the tissues, and that means better oxidation and increased metabolism. We might perhaps consider the increased perspiration caused by muscular exertion also as an effect favorable to the reduction of the body-weight.

In plain cases of obesity not complicated by any disturbance in the circulatory system, all sorts of muscular activity should be encouraged, like walking, climbing, horseback and bicycle riding, rowing, etc., especially as long as the diet is above the average line. It must, however, be remembered that, if the supply of nitrogenous food is insufficient, the muscular exertion might lead to a greater excretion of urea and to a deficit in the nitrogen-equilibrium. In cases showing a disturbance of the action of the heart, the muscular work must be done with great care, and is best restricted to walks and very mild climbing, starting with a minimum and gradually increasing according to the condition of the patient. He must be instructed to rest as soon as he feels palpitation. The effects of the moderate movement can be well supported by *massage*, which also must not be of a violent character.

During sleep the muscular activity of the body is at its minimum, being restricted to the contraction of the heart and the respiratory muscles; the tonicity of all the muscles is probably also diminished. Therefore in cases of obesity *long sleep should be discouraged;* six to seven hours a day are sufficient, especially in uncomplicated cases of obesity. Obese people have a special inclination for an after-meal sleep; it should not be permitted.

Hot baths, especially hot vapor or dry-air baths (Turkish) seem indeed to reduce the weight of the body in a moderate degree, as can be established by weighing the patient before and after the bath. Whether this is due to a loss of water by perspiration or to a genuine increase of the metabolism is not yet established. We should remember, however, that in a hot atmosphere there is less expenditure of energy—people therefore gain flesh in summer in spite of profuse perspiration—on account of the diminished heat-dissipation and relaxation of the muscular energy. Hydrotherapeutists, however, claim that the weight-reducing effect of the baths occurs only when there is an abrupt change from hot to cold and that it is the shock which increases the metabolism of the body.

Medicinal Treatment.—There are quite a number of drugs on record which were at one time or another recommended by some one of more or less acknowledged authority as efficient remedies against obesity. Iodide of potassium, liquor potassa, potassium bromide (with sodium carbonate in Barnay-Schindler reduction pills), acetic acid, etc., all were more or less often advocated, and they may indeed have effected some reduction in some cases of obesity. But the favorable results were apparently rare and not sufficiently convincing, and therefore none of these remedies has ever gained general acknowledgment. We need not enter upon any discussion of the merits of any of these drugs, the more especially as we

now possess an internal remedy for obesity, the efficacy of which became universally acknowledged within a short period. It is—

The Thyroid Treatment.—In our article on the Diseases of the Thyroid we took occasion to describe in detail the treatment of myxœdema with preparations of the thyroid gland. The striking reduction of the myxœdematous tissue in cases of myxœdema and cretinism soon gave rise to the trial and testing of the effect of the thyroid-feeding upon the accumulation of adipose tissue. Barron[1] was the first to record a reduction of ordinary corpulence by the administration of the thyroid, and James J. Putnam[2] recorded reductions of 40 and 47 pounds by this treatment, and soon quite a number of similar reports commenced to come in from all sides. Now it is a universally acknowledged fact that the thyroid rarely fails to reduce the weight of obese individuals. At first the thyroid was used in large doses, and there seemed to be no limit to the degree of reduction possible to attain by this treatment. In a discussion following the reading of my paper on the thyroid-therapy a trustworthy gentleman reported the case of a very obese patient who lost 100 pounds by the treatment with thyroid.

We know now that it is neither proper to use too large doses of the gland even in simple obesity, nor is it justifiable to accomplish such extraordinary reductions. Large doses of thyroid bring out in healthy persons also a number of discomforting symptoms, though they seem never to become as serious as they were found in the cases of myxœdema overdosed by thyroid (thyroidism), nor do these symptoms develop in all individuals; there are normal persons who can stand quite large doses of thyroid without experiencing any disagreeable effects. Another point of importance which has to be taken into consideration while treating obesity with thyroid, is the well-established fact that the decomposition of nitrogenous material has a distinct share in the loss of weight which is caused by the ingestion of thyroid (Wendelstadt and Bleibtreu). That this, however, is not the only cause of the reduction, as was apprehended by some writers, was proven, first, by the fact that the loss of carbon during the thyroid-feeding exceeds greatly the amount of carbon present in the quantity of the decomposed proteids as calculated by the excreted nitrogen; and secondly, by the considerable increase of the general metabolism as seen in the striking increase of the inhaled oxygen and the exhaled carbon dioxide (Magnus-Levy). Further than this, the deficit and the nitrogen-equilibrium can be met to some degree by the addition of proteid to the usual food of the person under treatment. Cunningham kept up animals simply by feeding them on thyroids alone, the proteids

[1] *Liverpool Med.-Chir. Journal*, Jan., 1893.

[2] *Trans. of Assoc. of Amer. Physicians*, May, 1893.

of the thyroid serving as food. The reduction of the body by the thyroid-feeding takes place without the aid of a change in the diet. An increase of the diet, however, overbalances the reducing effect of the thyroid-feeding.

My own experience with the treatment of obesity by thyroid is of the most satisfactory kind, none of my patients having ever had a complaint to make. But I never have given too large a dose, have never allowed the reduction to exceed 20 pounds, always attaining it gradually, and have never treated obesity for any other than good medical reasons. I begin with small doses, 3 to 5 grains of the fresh gland, increased very slowly while constantly having the patient under observation, discontinue the administration of the thyroid at the first sign of some disturbance, and never go above 15 grains a day even if well tolerated. In nearly all of the cases I have seen a reduction of weight finally follow a careful, prolonged, and patient administration of the thyroid. In a part of the cases the administration of the thyroid had often to be discontinued, and we had to be satisfied with the mere checking of the increase of weight. In all cases where a distinct discomfort, especially shortness of breath, was present, a pronounced relief was experienced by the patient shortly after the beginning of the treatment and long before there was any sign of a loss in weight. This is in accord with the observation made by some investigators that the change in the respiratory quotient (increased metabolism) shows up before there is yet any decrease in weight. When larger doses of thyroid were given with a satisfactory result, the only dietetic treatment I have advised was moderate out-door exercise like walking, and also climbing, if possible, and a moderate change in the distribution of food in favor of more proteids. The advice to take less meat, and drink instead more milk during the thyroid treatment applies only to the treatment of myxœdema or cretinism, and perhaps also goitre. When the effect of a full dose of thyroid was not satisfactory, the treatment was supported by a moderate dietetic regimen and according to the plan laid out above, cutting down especially sweets and malt beverages. However, I must repeat that, according to my experience, even the thyroid-feeding alone seldom fails to accomplish a final reduction in weight, if one only has patience and perseverance and is satisfied with such moderate reductions as one pound in two to three weeks. In obesity, too, as in myxœdema, the advice is in place to sometimes change the thyroid preparation. When such doses as 15 grains a day are given, it is advisable to have every third or fourth week an intermission for eight or ten days. Here too, as in myxœdema, these intermissions help to keep up the efficiency of the remedy. When the remedy is discontinued, eventually a return to the original weight might grad-

ually take place, especially when the thyroid-treatment was not supported by some dietetic measures. An early relapse, however, occurs mostly when the thyroid cure is hurriedly carried out and the loss of weight takes place rapidly. When the treatment has been carried out with care and patience, and the patients lose their flesh gradually, so to say imperceptibly, the effect keeps up after discontinuation of the treatment for a long time. A patient who took for six months, three weeks in every month, 10 grains of the fresh gland every day, and gradually lost about 15 pounds without observing any dietetic measures, has not yet regained any of her lost flesh though two years have passed since she discontinued treatment.

We can say that, when the thyroid administration is carried out discreetly and discriminately, with patience and with care, and is supported with such moderate dietetic measures as every patient can easily carry out, the treatment of obesity becomes an exceedingly thankful task.

I have had some experience also with the employment of iodothyrine for obesity. While I can confirm the fact that iodothyrine is capable of reducing fat, I must say that its effect on obesity is a good deal slower than even in myxœdema. As there is hardly any drawback, when the thyroid is handled with care, there seems to be for the present no good reason for a general recommendation to substitute the thyroid by the expensive iodothyrine. However, I have one patient whose stomach could not stand a minimal dose of the desiccated thyroid and who now takes without trouble quite large doses of iodothyrine with some undeniable effect.

Besides the favorable effect of the thyroid treatment upon general obesity I have had excellent success with this treatment in a case with multiple lipomata. The numerous sensitive swellings totally disappeared within five months. The same result was obtained by Dr. F. Kammerer of New York in a similar case, with quite large lipomata.

There is at present a general consensus of opinion to avoid the thyroid treatment in all cases of obesity which show some heart symptoms. By my observation of the early relief which some obese patients with shortness of breath and similar discomforts derive from a few doses of thyroid, I was led to the theory that it is at the heart that the first removal of the fat begins to take place, and I started to try cautiously very small doses of thyroid in cases of fatty infiltration of the heart. Without insisting upon the correctness of my theory, I can state that the practical results are exceedingly satisfactory to me. I quote briefly a few instances:

Mrs. K., thirty-eight years of age, always somewhat stout, and with a systolic murmur, ceased menstruating about three years ago and

became gradually very stout, especially in the mammary, abdominal, and gluteal regions. Recently she became very sick, had five to six characteristic spells a day of angina pectoris with extreme præcordial pain penetrating to the back and radiating into the right arm, constant bradycardia, pulse forty to forty-four per minute, profuse perspiration, shortness of breath, etc. Percussion of heart impossible on account of fat. Nitro-glycerin made the condition worse; iodides, strychnine, valerian, bromides, iron, etc. had no effect. I gave her two and a half grains of desiccated thyroid once a day. After thirty-six hours the pulse went up to sixty per minute, the attacks subsided entirely, the patient stating that a certain inside pressure is leaving her and she can breathe better. After two days more the pulse went up to seventy-two per minute and the patient left her bed. She had no other treatment during this time.

Miss S., seventeen years of age, short, becomes constantly stouter, looks exceedingly anæmic, has often fainting spells, and can hardly walk. Systolic murmur, moderate dilatation. Diagnosis: Anæmic obesity. Arsenic of no use. Blaud's pills improve color but not the fainting spells. Prescribed iodothyrine, 5 grains daily. After four days no more fainting spells; walks now three to five miles a day; lost one pound in two weeks; and she and her family are delighted.

Mrs. P., forty-eight years of age, menstruation still regular, weight increasing, now 192 pounds, for years has had "asthma." Condition now intolerable, cannot climb the stairs, slightest exertion causes dyspnœa and palpitation, profuse perspiration, sits up nights in bed. Heart-sounds clear but hardly audible, râles in the lungs, œdema of the legs, etc. Diagnosis: Fatty infiltration of the heart. I gave her two grains a day of the desiccated thyroid (Parke, Davis & Co.). There was a distinct relief even the next day. The dose was gradually increased to 6 grains a day, which she has taken continually for fifteen weeks. She lost eighteen pounds; œdema, palpitation, "asthma," perspiration, fatigue, are all gone. It is now about twenty-six months since the woman took any thyroid, and her condition continues good.

With regard to the *literature* on the subject of obesity I refer to the works of N. Ebstein: *Die Fettleibigkeit und ihre Behandlung;* K. Kisch: *Die Fettleibigkeit* (*Lipomatosis universalis*), and E. Pfeiffer: "Die Behandlung der Fettleibigkeit," in *Penzoldt und Stinzing's Handbuch der speziellen Therapie*, vol. ii. part 2, p. 16. The reader will find in these works complete lists of the literature of this subject.

DIABETES MELLITUS.

By H. A. HARE, M. D.

In the treatment of diabetes mellitus it is not possible at present for us to base our therapeutic measures on rational grounds except in small part, for as yet neither the physiologist, the physiological chemist, nor the pathologist have been able to inform us as to the nutritive disorders and metabolic changes which underlie the affection as we meet with it in practice.

One thing seems certain in connection with the study of this affection, namely, that the syndrome which causes us to make a diagnosis of diabetes is only composed of symptoms, and no one of these is the cause of the disease. Thus, as in malarial fever, the chill, the fever, and the sweat form a fairly pathognomonic group of symptoms which a few years ago were recognized as the results of some cause which we had not as yet discovered, but which is now known to be due to infection by a specific micro-organism: so to-day the polyuria, glycosuria, hunger, thirst, wasting, itching, furunculosis, and the final development of coma in some cases, means the presence of diabetes mellitus; as dyspnœa, emphysema, and cyanosis may be the manifestations of an asthmatic attack the provoking cause of which is unknown to us.

In asthma the remedial measures looking to a cure are often futile and can never be rationally applied until by thorough examination we find that the attacks depend upon cardiac, gastric, renal, nasal, or other causes, and treatment directed to the relief of the symptoms alone is but little more than temporary in its results. In diabetes our position as rational therapeutists is, however, worse than it is in respect to either malarial fever or asthma; for in the first of these we have long had a specific remedy in quinine, which we now know destroys the malarial organism, and in asthma we have various remedies which by their almost specific effect on the heart, kidneys, or stomach act equally well; whereas in diabetes mellitus we are face to face with a condition, grave in the extreme, in many cases, about which we know almost nothing concerning its minute and important underlying causes. We know of course that a condition exists in which the body is unable to properly utilize carbohydrate materials; that, in other cases, it is not only unfit to do this, but also is so perverted in its function that

it actually uses its own tissues, or other proteid substances given in the food, with which to make sugar which is then poured out in the urine; and, finally, that in some cases it develops a poisonous substance which when it accumulates in the blood speedily causes death. All these processes in their methods and details are practically unknown to us, and although the most ingenious hypotheses have been advanced to clear up the subject, and although the most laborious and accurate investigations have been made for years, as for example by Claude Bernard, Pavy, Von Noorden, Seegen, Lépine, and a host of others, the results so far obtained indicate chiefly that many causes may exist for this curious malady, each one of which may be utterly and entirely apart from the others. In other words, as has already been said, diabetes mellitus is a symptom of a number of underlying causes.

From the mass of research, clinical and otherwise, the following facts seem clear and certain:

First: That at all times there exists in the blood glucose in minute quantities, and that this is utilized for the development of heat and fat in the tissues, and perhaps for force.

Second: That glucose in exceedingly minute amounts is nearly always to be found in the normal urine, but can only be distinguished as a trace by the most delicate tests applied to large amounts of the urine.

Third: That the appearance of glycosuria is not necessarily the development of diabetes, any more than the appearance of albuminuria is the development of Bright's disease. Both are the dominant and most important signs of these affections, and in their absence grave doubt may exist as to the diagnosis; but their presence is not pathognomonic.

Fourth: That glycosuria may occur from the ingestion of an excess of carbohydrates; in other words, as an overflow of starchy educts which takes place when the system has received more than it can use.

Fifth: That transient glycosuria should be regarded as a danger-signal indicating that the ability of the body to deal with starches is impaired, and that its overloading with more starch than it can handle will not only result in a leakage—glycosuria, but in addition so disorder the mechanism of the metabolic processes as to result in the development of the other grave signs of diabetes.

Sixth: That in diabetes mellitus the ability of the nutritive processes is so impaired that the ingestion of carbohydrates by the patient is not only equivalent to pouring oil into a can which cannot hold it, but in addition is equivalent to pouring oil into a leaking can which is held over a fire; not only is the oil not utilizable under these circumstances, but it actually does harm.

The basis of the whole treatment of diabetes mellitus rests to-day upon our knowledge of these facts, chiefly the last two just named, and for this reason we may lay down the rule that the first and most important and most evident therapeutic procedure is to eliminate from the diet of the diabetic those starchy articles which the body is unable to deal with. That this is not really a curative measure is self-evident. It does not result in the repair of the perverted and disorganized functions of nutrition except that by giving them a rest it permits repair and prevents further damage.

The **dietetic treatment** of diabetes mellitus is, therefore, far more important than any other.

There are many diet-lists arranged and designed by different clinicians, all of which strive to decrease the carbohydrate articles to a minimum or to exclude them altogether from the patient's table. The rigor of these lists depends upon the individual views of their designers, and their application so far as rigor is concerned depends to some extent upon the strength of the patient, and his ability to manage small amounts of starch or his inability to do so.

We can therefore divide diabetic patients into several clinical or dietetic groups:

Group I. Those who immediately on taking carbohydrates suffer from a marked increase in the glycosuria and urinary flow. These patients are usually young in years, and their inability to manage even small amounts of carbohydrates is often in direct proportion to their youth. In these patients the diet-list should be rigorously adhered to, except in the cases soon to be named, where an absolute withdrawal of all starch results in greater disaster than its use in small quantities.

Group II. Those who have a marked increase in glycosuria only when they take considerable amounts of starch, and not when small amounts are used.

Group III. (*a*) Those advanced in years, and often obese or gouty, in whom the symptoms of diabetes are not pressing, and in whom the prognosis, with ordinary precautions as to habits, is not unfavorable. (*b*) Those who develop glycosuria on taking much starchy food.

Group IV. Those who fail so rapidly if starches are withheld from them that it would seem as if they required starches to make up for the drain of sugar in the urine.

I. A rigid diet-list for the first class may be adopted as follows, any of the articles named being allowable in full quantity:

Fresh Meats.—Any muscular part of the ox or of any other domestic animal, of the deer, or of wild or domestic fowls or birds. These may be cooked in any simple fashion the result of which does not render

digestion difficult. Terrapin may also be taken. The sweetbread, tongue, heart, and brains of these animals may also be used, plainly cooked, without starch or sugar in the sauce.

Preserved meats of the same sorts as just named are allowable.

Fish of all kinds, if plainly cooked without bread-crumbs or cracker-crumbs. Preferably fried. Preserved fish also. Caviare and cod-liver oil may be given.

Shell-fish.—Clams, crabs, oysters (few), turtle.

Eggs freely.

Fats freely.

Vegetables.—All green vegetables such as lettuce, cress, spinach, cucumbers, onions, asparagus, cauliflower, cabbage, etc.

Spices.—All kinds, in moderate amounts.

Soups.—Clear soups without starch thickening or vegetables.

Cheeses.—Chiefly fatty cheeses like cream cheese, Gorgonzola, Neufchâtel, etc.

Waters.—All effervescing waters, but not sweet soda-water. Waters with lemon-juice added.

Wines and Liquors.—Moselle and Rhine wines, claret, rye whiskey, brandy, cognac, arrack.

Coffee and tea are permitted without sugar but with saccharin.

This diet if possible should be rigorously enforced, and only relaxed when the patient rebels beyond restraint or craves starches to such extent as to be actually in misery from their withdrawal. Then a very small piece of bread may be given once or twice, or in its stead, and better, a little liver, some sausage, cocoa without sugar, turnips, celery, pumpkin, or a few green peas may be allowed. Even if these are allowed frequently, every now and again the patient should follow for several weeks the rigid diet absolutely.

II. For the second class we can allow the articles named in the last paragraph as luxuries for the severe cases, and in addition allow small amounts of beans, mushrooms, artichokes, and Brussels sprouts, with radishes, tomatoes, a few nuts, a small pear, or a small apple or sour orange. Cherries, plums, and currants in small amounts may also be given.

III. The third class may have small amounts (one slice at a meal) of bread, small quantities of zwieback, of chocolate, potatoes and apples, one banana, some walnuts, chestnuts, one peach or some small berries, in addition to the articles named for the first and second classes. The nearer all three classes can follow the strictest diet-list, the better for them.

IV. In arranging the diet for the fourth class we must govern the supply of carbohydrates by frequent examination of the urine. If a patient following the rigorous diet fails rapidly, and a small allowance

of starch does not materially increase the glycosuria and does increase his strength, he must have it in limited amounts.

In all classes of cases the fact that the fats are nutritious, and in one sense can take part of the place of starch in the nutrition, is not to be forgotten, and for this reason the free use of butter, of fried articles, and of fatty foods such as fat salmon, olive oil, fatty cheeses, and the fat part of meats is advisable up to the point at which the patient's digestion is about to fail.

Having discussed the possible diet-lists, we now come to the effects to be sought for and gained by the administration of drugs.

Drugs.—Before discussing these it may be recalled that diabetes may result from syphilis, from gout, from nervous exhaustion, and from growths in the central nervous system which result in functional disturbance in distant organs, chiefly in the blood-supply of the liver. Again, it is not to be forgotten that disease involving the pancreas to such an extent as to prevent it from carrying out its *internal secretion* into the blood-vessels or lymphatics may result in diabetes.

It seems hardly necessary to point out in connection with diabetes in a syphilitic that the iodides and mercury are indicated, particularly the iodides. The effect of these drugs upon syphilis makes a diabetes mellitus due to this infection a disease with a possibly hopeful prognosis, even in a young person, if the syphilis be the cause of the diabetes. The condition of the kidneys and that of the digestion are the only points of caution in this treatment. All other anti-syphilitic treatment may be utilized except hot baths or cold baths, which are generally too relaxing or too exhausting for a feeble diabetic struggling against two grave ailments. As pointed out in Dr. Martin's article on Syphilis, the best treatment by mercury is by inunction.

In those cases in which there is a gouty history, hereditary or acquired, the salicylates in full doses are useful, and even colchicum in limited quantities is to be employed. Arsenic is also peculiarly useful in some of those patients, and if there is any degenerative vascular change nitro-glycerin may be employed. Usually, however, in the gouty diabetic with degenerated vessels the iodides are preferable to all other drugs. Antipyrin may also do good in full dose.

We now come to a third group of cases, the treatment of which is of great importance because they are a numerous class, and can sometimes be much benefited by drugs, namely, that class which develops diabetes after some severe nervous shock or prolonged mental strain in business, professional work, or in the illness and death of near relatives. In this class the institution of the "rest-cure" of Weir Mitchell, as described in Vol. I. of this SYSTEM by Dr. John K. Mitchell, or the avoidance of all business cares and worries by a trip from home to some healthful spot where rest can be obtained is necessary. In the

way of drugs, opium stands *facile princeps*, itself or its alkaloids morphine and codeine. In respect to these drugs it may be said fearlessly that while they sometimes fail, as do all remedies in many diabetics, that they diminish the excretion of sugar and the polyuria secondarily, and put aside the other symptoms, such as itching and sleeplessness, with a constancy which, in view of our helplessness in this disease, is, to say the least, most encouraging. They will not allow the patient to disregard his dietetic instructions, but they will often allow the use of needed carbohydrates which, without them, the patient could not take, and they aid materially in the fall in sugar-excretion which occurs on instituting an anti-diabetic diet. It may be said, of course, that the fall in the excretion of sugar would be progressive without the opiate, but repeated clinical experience has convinced the writer that the use of this drug emphasizes the effects of the deprivation of starches. This fact is also definitely pointed to by the clinical studies in Charing Cross Hospital made some years ago by Mitchell Bruce, and before and since his studies confirmed by other clinicians. Particularly is opium advisable in those cases in which the patient, unable to leave his business affairs entirely, needs some nervous sedative to "take the edge off" his anxieties. In the use of opium or its alkaloids, however, we must employ large and rapidly ascending doses. The ordinary diabetic can take massive doses of morphine without any manifestation of its physiological effects save in the decrease in the sugar and urinary flow. At the time of writing this article the author has under his care two diabetics representing in one case the class of overworked business men, the other a man who received a great nervous shock by reason of an accident. The first is now taking 1 grain of morphine three times a day by the mouth, and the second 2 grains three times a day by the mouth. Neither manifests any sign of sleepiness or mental torpor nor any ordinary morphine influence, even in the pupils. This dose has been reached in fifteen days by rapidly raising the daily dose from $\frac{1}{6}$ grain three times a day. In the first patient the urine has decreased a quart under a moderately rigorous but by no means absolute anti-diabetic diet. In the second it has fallen from 8 quarts in twenty-four hours to 2 quarts in twenty-four hours, and has remained at about the latter amount for a week. This patient also receives a modified diet, but eats at least two slices of bread a day, and often takes other farinaceous articles. None of these patients seem to develop the true morphine-habit, although the relief of the disagreeable symptoms such as itching and nervousness naturally makes them ready to continue the drug.

In thus highly endorsing the employment of opium and its derivatives the author is well aware that apparent relief may be seen in the natural variations which take place in the course of this disease, and

that in many cases the remedy will fail. Opium itself is most powerful for good, morphine stands next, and codeine is the most expensive and least efficacious. The drug should be fitted to the necessities and the pocket-book of the patient. Further, it is to be remembered that the doses must be ascending, and are to be governed, not by the amount in grains, but by the effects. The patient should take in the end as many grains as are necessary to produce slight drowsiness or slightly contracted pupils. Usually the drug is best given in non-compressed tablet triturates, as by this means the dose is easily increased and the patient can carry it with him without inconvenience.

In this class of cases antipyrin and acetanilide also seem useful, but must be given in full doses. The writer has no experience in their use. In the use of the bromides in full doses, so highly commended by some as nervous sedative treatment, the writer only sees depression and malnutrition from their effects when taken for long periods of time.

The use of the pancreas or its extract in the treatment of diabetes mellitus depends upon the hope that by this means the body will be supplied with that substance which the healthy pancreas naturally pours out into the system. That this internal secretion is necessary for the maintenance of health is proved by great numbers of experiments on the effects of extirpation of this gland in animals, by the fact that death ensues in man from diabetes when this gland is removed (Bull's case), and that diabetes has existed in cases in which grave and universal pancreatic disease destroying the gland is found to be present at the post-mortem examination. The results reached in the cases of diabetes so far reported as treated in this manner are not encouraging since they were not benefited to any great extent, but as they were not all cases of pancreatic disease the test is not complete or reliable. Again, the rarity of diabetes due to pancreatic disease prevents the frequent rational use of this remedy.

Of the value of jambul in the treatment of diabetes the author has had no experience, and its record in medicine seems hardly to warrant much reliance on it.

Mineral Waters.—The value of mineral waters in the treatment of diabetes is greatly exaggerated, yet it cannot be denied that the use of the Carlsbad water *at Carlsbad,* associated with the strict regimen there instituted, greatly benefits patients with this disease, particularly if they are gouty or have been *bon vivants.* In anæmic persons those waters which contain traces of iron, and more important, arsenic, are often useful not so much for their effects on the diabetes as for improving the general health. Such water may be found at La Bourboule. In other instances, usually gouty in character, particularly if the patient is too feeble to submit to the rigorous treatment of Carlsbad, resort may

be had to the alkaline sodium bicarbonate waters of Vichy, Vals, or Contrexeville in France. It is worthy of note that all the springs for the cure of diabetes produce their good effects only when carefully arranged routine measures in relation to diet and habits of life are carried out.

Bathing.—The diabetic patient will often find relief from itching and peripheral irritation in a warm bath, which should be as hot as possible and not tepid. He will rarely be able to stand any cold baths because his heat-production is defective through his loss of carbohydrates. In some cases of moderate diabetes with little wasting, or if the patient is an obese diabetic, hot and cold douches are useful. They should be applied gradually and the first dash should be of hot water and the next of cold. The cold should not be too great (not below 70° F. at first), and the dash of heat and cold should not last over one minute each at the first, lest proper reaction fail to set in.

Often sponging the body with alcohol and water or salt and whiskey will keep the skin clean and avoid the relaxation of the bath.

Climate.—As a rule, diabetic patients do best in a semi-mountainous region such as will be found in Asheville, N. C., or Thomasville, Georgia. The latter is not mountainous, but it is fairly equable and is not a damp climate. High altitudes are nearly always harmful, as they increase the nervous irritability of the patient, are apt to be cold and to produce congestions by chilling him. Similarly seashore resorts are not advantageous, as diabetics do not withstand a damp atmosphere as a rule.

Clothing.—The very fact that the diabetic lacks those elements in his food which ordinarily would add heat to his body and lay a cover of fat under his skin, and the fact that he is especially prone to pulmonary and other visceral congestions, renders the constant use of well-made woollen underwear, such as that of Jaeger, a necessity.

Exercise.—A diabetic patient should not take violent exercise. Gentle walking, or riding a horse, care being taken that fatigue does not result, is advisable, but any hard riding, as bicycling for a great distance, is harmful for evident reasons.

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